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OREGON POWER SITES

In view of the recognized importance of the water power sites along the western base of the Cascade Range from the Feather River in California, to the Columbia River in Oregon, but especially in the vicinity of Portland, Oregon, J. S. Diller, of the United States Geological Survey, who has made a general reconnaissance of the range, was recently sent to make a brief study of the canyon of the Clackamas River at a point near Cazadero, about 20 miles southeast of Oregon City.

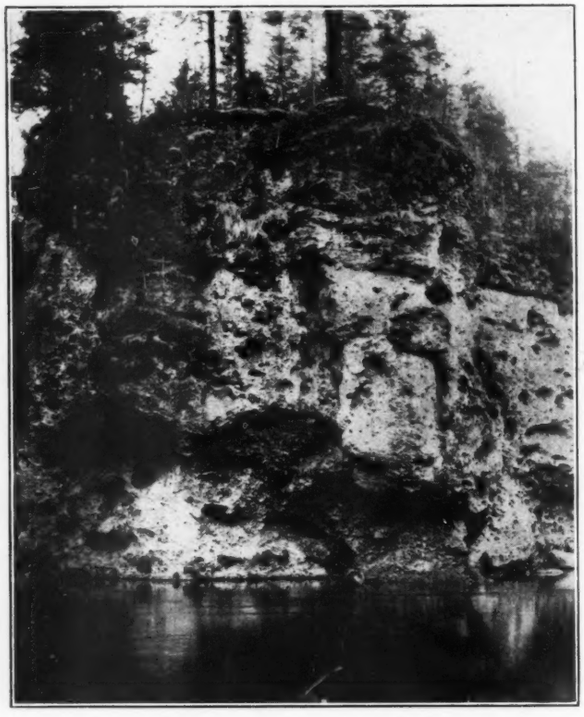
Weathered Slope of Volcanic Breccia in Northern California: Similar to that of the the Clackamas Canyon, Oregon.

He reports that the plain lying along the western base of the Cascade Range at an altitude of about 1000 feet is traversed by the Clackamas River in a canyon, and at a point about two miles east of Cazadero the

canyon is approximately 500 feet deep with moderately steep slopes of rock cliffs, soil and talus stretches, more gentle near the top where there are land slides, and also at the bottom where there are local terraces carried with gravel.

The rocks of the canyon walls are of four forms, volcanic breccias, lava sheets, volcanic dikes, and terrace gravels. Of these, volcanic breccias are by far the most abundant and important.

The volcanic breccia (bedrock) is made up of unassorted angular fragments of lava andesite and basalt of various colors ranging in size from dust particles and grains of sand to large rock fragments many feet in diameter. This fragmental material was blown by explosive eruption from the volcanic craters higher up on the range and fell upon the mountain slopes where it became so saturated with water from the copious rains accompanying the eruptions that it



Volcanic Breccia of the Clackamas Canyon, Oregon, showing Unassorted, Angular, Fragmental Character of Formation.

flowed in great steaming sheets from the Cascade Range to the gentle slope of the plains, in much the same way as similar material flowed down the old stream channels on the western slope of the Sierra Nevada in California and covered the early and often rich deposits of auriferous gravels.

Sheets of solid non-fragmental lava forming part of the bedrock and outcropping on the slopes of the canyon occur within and between the great sheets of volcanic breccia. Some of the lava sheets are basalt, others are andesite and they are usually less than 30 feet in thickness. The basalts are generally very porous and gray or dark. The andesites are often reddish and porphyritic with white crystals of feldspar. One of the largest lava sheets is well exposed by the water's edge on the right bank of the river, a short distance below the fishery dam. Another sheet outcrops above the dam, 100 feet or so from the water level, and at the proposed dam site two miles above Cazadero there are a number of thin lava sheets forming small cliffs on the canyon slopes. The depth to which the sheets of volcanic breccia and lava extend in the Cazadero region cannot be readily determined, but it is certainly hundreds of feet and may be, as it is along the Santiam and McKenzie River canyons, over 1000 feet in thickness.

Nearly vertical dikes of basalt cut up through the sheets of volcanic breccia and lava and their outcrops on the surface have the direction of N. 65 deg. W. approximately parallel to the general course of the canyon, from the Forks to Barton. A small group of dikes about 15 feet in thickness, the only ones noted in the region, is well exposed along the water's edge a few hundred yards above the proposed dam site.

The dikes and sheets of lava in some places have a well developed columnar jointing which divides the rock into columns. In the case of the dikes the columns lie horizontally and extend across the dike. In the lava flows the columns are vertical, but in all cases the columnar joint cracks are limited to the dike or lava sheet and do not extend into the adjacent rock nor make an opening of great extent. There is, however, another set of joints, parallel joints, the open cracks of which cut up through the volcanic breccias and sheets of lava about vertically in a direction approximately parallel to the course of the canyon. The most pronounced joint cracks of this type were noted along the southern brink of the canyon nearly opposite the proposed dam site. Such joints may be of considerable extent and form important openings for the circulation of water. Well developed joint cracks of this system were not seen in the exposed bedrock of the dam site, but they may be expected and should be carefully looked for where the bedrock is covered with soil or gravel. It is especially significant that the dikes are approximately parallel to these joint cracks and suggest that these joint cracks may extend to great depths.

The parallel joints have so weakened the canyon walls as to produce local land slides. This is especially the case on the left (south) side of the canyon opposite the proposed dam site, two miles northeast of Cazadero. A stream of rock fragments broken from the jointed cliff at the top of the canyon slope comes down a shallow ravine to the river about a quarter of a mile above the dam site, while another slide from the top cliffs a short distance farther west reaches the river below the dam site. The shoulder of the left bank that narrows the canyon for the dam site is bounded by these two slides east and west, and it is possible that this shoulder itself may have moved, thus rendering the proposed support of the dam on the left bank much less secure. No conclusive evidence was seen of such movement. If such slipping took place the underlying slipping plane must be a water carrier, and should be found by the drills and test pits in the left bank that go below the river level. Along such a plain there would be more or less fine material, soft and slippery like clay when wet. Such material engineers often call "soapstone." It would form no core in drilling and might be readily overlooked.

From the nature of the volcanic breccia which forms by far the greater part of the canyon walls it is evident that the drill cores will differ from one another very much when compared. Where the drill goes through a sheet of lava or a large solid fragment it will yield a good core, but where it penetrates the finer material, the volcanic ashes, in which the fragments of all sizes are embedded, the core fails, the material is pulverized by the drill and washed away, and yet the extent of this material that is washed away is of the greatest importance for it is the weakest element in the structure and the one which when saturated with water under pressure is most likely to become engineers' "soapstone." Soapstone, properly so-called, does not occur in that region at all, but decomposed lava, volcanic ashes and clay, all of which when saturated with water may become slippery and would be called "soapstone" by engineers, occur locally in the volcanic breccia.

Large caverns and cavities, or pockets of loose earth and stones, are not to be expected in the volcanic breccia, but owing to the manner of accumulation of the material there may be small openings and the porosity of the rock is high. It is pervious to water, and for this reason similar material is used for making water coolers.

The crushing strength of the volcanic breccia is, of course, small as compared with granite, limestone, and most other rocks, and this taken in connection with its porosity and the possible existence of undiscovered joint cracks seems to make a large reinforcement with concrete necessary, in order to furnish strength and prevent seepage as well as erosion.

The conditions that confront the engineer along the Clackamas River in the volcanic breccia plain region are very much the same as will be found all along the western foot of the Cascade Range from the Columbia River in Oregon, to Feather River in California, one of the most important water power belts in the United States, and the successful solution of the problem it presents at one point will greatly facilitate the work elsewhere.

GOVERNMENT POLICY WITH RESPECT TO WATER-POWER SITES.

In the annual report of Secretary Richard A. Ballinger, of the Department of the Interior, the following statements are made regarding the policy which he recommends in connection with water-power sites on government land:

In anticipation of new legislation by Congress to prevent the acquisition of power sites on the public domain by private persons or corporations, with the view of monopolizing or adversely controlling them against the public interest, there have been temporarily withdrawn from all forms of entry approximately 603,355 acres, covering all locations known to possess power possibilities on unappropriated lands outside of national forests. Without such withdrawals these sites would be enterable under existing laws, and their patenting would leave the general government powerless to impose any limitations as to their use. If the Federal government desires to exercise control or supervision over water-power development on the public domain, it can only do so by limitations imposed upon the disposal of power and reservoir sites upon the public lands, the waters of the streams being subject to State jurisdiction in their appropriation and beneficial use. I would, therefore, advise that the Congress be asked to enact a measure that will authorize the classification of all lands capable of being used for water-power development, and to direct their disposal, through this department, under substantially the following conditions:

(1.) That the title to such lands be reserved in the Federal government, and only an easement granted for the purpose of developing and transmitting electrical power for private and public use, and for the storage of waters for power, irrigation and other uses;

(2.) That such easement be granted for a limited period, with a maximum of at least 30 years, and the option of renewal for stated periods upon agreed terms;

(3.) That entry shall be accompanied by plans and specifications covering the works sought to be installed, and covering the maximum horsepower capable of development at such rate; also, that a substantial entry fee be paid to show good faith, and that a transfer to the United States of the necessary water rights to permit of the estimated power development be made;

(4.) That the construction period allowed entrymen for the development of at least 25 per cent of such power shall not extend beyond four years, or such further time as may be granted by the Secretary of the Interior upon a proper showing;

(5.) That a moderate charge shall be made on the capital invested, or upon the gross earnings of the project for the first ten years of operation, adjusted at each subsequent ten-year period, and equitably determined by appraisement;

(6.) That all rights and easements shall be forfeitable for failure to make development within the limitations imposed or upon entry into any contract or combination to charge or fix rates beyond a reasonable profit on the investment and cost of operation, or entry into any agreement or combination to limit the supply of electrical current, or failure to operate the plant; and,

(7.) That all books and accounts shall always be subject to the inspection of the department.

Unreasonable or narrow restriction beyond the necessity of public protection against monopoly, or extortion in charges, will, of course, defeat development and serve no useful purpose. The statute should, therefore, while giving full protection against the abuses of the privilege extended, so far as consistent, encourage investment in these projects; and it must always be borne in mind that excessive charges for the franchise will fall upon the consumer. Legislation of this character proceeds upon the theory that Congress can impose such contractual terms and conditions as it sees fit in the sale or use permitted of government lands so long as such limitations do not conflict with the powers properly exercised by the State wherein they may be situated.

THE VALUE OF WATER-POWER SECURITIES[1]

BY HENRY L. DOHERTY.

There is probably no other class of securities which deserves so well the support of the public as those issued by companies owning and operating successful water power properties, and having a permanent and relatively non-competitive market.

Except for the possibility of further development in heat engines which will materially increase their commercial efficiency, thus tending to reduce the cost of power from fuel, all of our water power plants will tend to grow more and more valuable, as it is improbable that fuel will ever sell at a lesser cost, and more than probable that the cost will gradually increase. The reduction in first cost of heat engines, the increase of fuel economy, and the decrease in cost of repairs, are the only factors which will tend to lessen the market value of power from hydroelectric plants.

Almost every other class of industrial or investment property is apt to depreciate at a much greater rate, and be subjected to greater seen and unforseen risks. For instance, business enterprises based on patents become less valuable as the patents expire; substitutes for manufactured commodities can often be found, or there may be developed other methods of manufacture which will prove more economical. As an exaggerated example, coal mining operations might be cited; the more coal is sold, the less the coal company has left for sale, unless new property is constantly purchased.

Compared with almost every other class of investment, a water power plant is far preferable. The source of supply is, in the main, perpetual, although in some instances somewhat modified by timber operations and changes in meterological conditions. Such modifications are, on the whole, more than offset by the possibilities of further power or irrigation developments which will provide reservoir capacity and make useful flood waters which have heretofore been unavailable for power.

Probably the greatest stroke of statesmanship of the last national administration was the interest aroused in the conservation of our natural resources. Unfortunately, the efforts of the administration were either largely misdirected or very generally misunderstood in regard to water powers.

Immense amounts of power are daily going to waste. The tendency of the Federal Government, and of many of the State governments, seems to be directed toward obstructing rather than encouraging the development of water powers. This Institute can do valuable work in educating the public as to the restrictions which should be made and the encouragement which should be given to enterprises of this character.

The most pressing need in the matter of the conservation of our natural resources lies in the direction of conserving our various sources of fuel supply. Every undeveloped water power means a constant unnecessary fuel consumption.

Government, both State and National, should remove as far as possible every unnecessary obstacle to water power development. Rights of eminent domain should be given universally to water power projects. Encouragement, and perhaps direction, should be given which will insure the development of the greatest possible portion of the total energy available from our streams. Unintelligent engineering, or hampered finances, may result in stream developments which permanently limit the power production to a small fraction only of the total power which the stream might have been made to produce. For this reason, intelligent planning and engineering will play a most important part in the future history of the conservation of our natural resources.

Combination projects for both irrigation and power can often be made highly profitable where commercial success for either project alone would be impossible. It is therefore necessary that the engineer who has the responsibility of determining the value of prospective power developments should be proficient in the engineering of irrigation—and it is probably impossible fully to cover the field of hydroelectric engineering without knowing all of the essential details of irrigation engineering as well. This opens up to this Institute a necessary field of work which even now seems somewhat strange and a few years ago would have been entirely remote. Power and irrigation projects, wherein the power must be generated at one point and transmitted to another point and there provide irrigation by means of pumping, is alone worth serious consideration. As interruptions to supply due to long transmission lines are of relatively less importance in such service, it is possible to lessen the transmission investment and operate at distances which would be prohibitive for some other classes of work.

The present state of the art in electro-chemical processes is a factor which makes possible the profitable development of many water powers. Still further developments along electro-chemical lines may add materially to the value of water power projects which now have no available market. Special attention should be paid to processes which do not require a continuous supply of current, thus permitting the utilization of power from water which would otherwise run to waste.

Were we to assume that there is no risk in the development of water power projects, and that their operation has proved universally satisfactory, we should simply retard the correction of some of the difficulties which have been encountered. We have learned by experience that the cost of development often proves excessive and far beyond the estimates made by engineers enjoying good reputations. We have found that frequently the power expected has not been realized. We have found that transmission lines will not yield that reliability of service which can be secured from a steam plant generating at the point where the power is utilized.

Failure to realize expectations in regard to, cost of development, amount of power to be sold, existence of market (or of market at the price anticipated) and reliable service, has played an important part in the retardation of development of water power projects. The treatment of any one of these disappointing features would alone furnish subject-matter for at least one, and perhaps many more papers. It is unfor-

[1]Extract from paper entitled "Comments on Development and Operation of Hydro-Electric Plants," as presented before the American Institute of Electrical Engineers, New York, December 16, 1909.

tunate that mistakes have been made, and that anticipations have not always been realized. If, however, we are to learn by experience, then the broadest possible discussion of these subjects is to be desired. It would contribute much to the ease of developing the now unused water powers if these difficulties could be overcome, or if the public could be made to understand the degree of risk and the cause for the existence of the risk.

Generally speaking, there is no more reason why anticipations should not be realized in water power enterprizes than in other enterprizes, if the proper amount of investigation and preliminary work is done. Unfortunately, however, the engineering investigation to determine the cost of a hydroelectric power proposition, and the exact amount of power available, is often a very expensive matter.

Accurate determination of the power available can be made only from complete data, and such data are obtainable only as the result of measurements extending over a term of many years. Our water power projects are exploited on everything from prospectuses based on the most complete data for determining every feature of the available power, up to and including the prospectus based on absolutely no reliable data.

Bankers, underwriters, and investors have formulated various rules regarding water power propositions. One prominent banker gave me this rule:

> We will not consider a water power project unless, after doubling the cost, cutting the available power in two, and reducing the market price by 40 per cent it will still show interest on the bonds necessary to issue.

This was spoken more or less in jest, but it and many similar statements warrant the belief that except among professional engineers the same, or similar, fixed and arbitrary rules for determining the merits of new projects are apt to be used by all classes of people who are to furnish the money for their development.

There is no reason why water power projects, with reliable stream gaugings covering a number of years, cannot be estimated, as to cost of construction and earnings, to a degree of accuracy closely approaching that which now pertains to the construction and earnings of modern office buildings, or similar enterprises.

If fixed additions to cost and fixed discounts from earnings are to be applied to water power projects, then we are apt to have the condition that only the poorer projects will be developed. The less known about an undeveloped water power the more readily can an attractive prospectus be written, leaving more than ample margin for any arbitrary deduction, while complete knowledge based on a thorough, honest, and intelligent investigation bring the promised earnings to a point which would not permit of further arbitrary deduction—nor, in truth, is further deduction needed.

After a proper examination has been made of a proposed water power plant, where the behavior of the stream is a matter of reliable record for several years, an enterprise of this character can safely be undertaken on a very narrow margin of profit. If, however, the investing public are offered a proposition for which a return of 10 per cent is estimated by conservative operators, based on careful and complete investigation, while other operators offer investment in a project for which they promise 40 per cent, the 10 per cent proposition is apt to go begging, even though it be well known that the source of the 40 per cent proposition is not of a character to warrant the investment of real money.

A confused condition exists in the popular mind in regard to the marketing of power. The inability of the public to understand this matter has been a great obstacle in the development of power propositions—and in this matter the electrical engineering fraternity has been more or less to blame. Cost of power is sometimes figured and stated on a kilowatt-hour basis, and at other times on the basis of peak load, or what might be termed a capacity basis. Without knowledge of load-factor, or simultaneous demand-factor, figures stated in these different ways may prove so misleading as to bring about expectations of returns varying all the way from $8 to $300 per horse power of station capacity. This confusion has played no small part in the mistakes which have been made; and these mistakes have caused the investing public to mistrust their ability to make correct deductions.

The problem of reliable service from long transmission lines is much further from solution than all of the other problems that have done so much to contribute obstacles to rapid development. Good engineering talent and other proper precautions will insure that the cost of construction shall be no greater than that promised. We can also accurately determine the available power, and can insure ourselves against disappointments in market. The best of engineering talent does not seem, however, able to promise for a transmission line the same continuity of operation that can be secured from a steam plant located at the point where the power is to be used, and this introduces many serious obstacles to the development of our water power projects. The importance of continuity of service varies in degree with almost every customer served. To some industries a mishap which causes even a fall in voltage or a change in frequency may be a serious matter.

The writer does not wish to appear as viewing the water power problem from a purely financial standpoint, but still it is the financial standpoint which determines whether a water power shall or shall not be developed.

If anybody will agree to furnish the money, there are plenty of men who will agree to furnish all of the other ingredients for developing complete water powers at a rate at least twenty times the present rate of development.

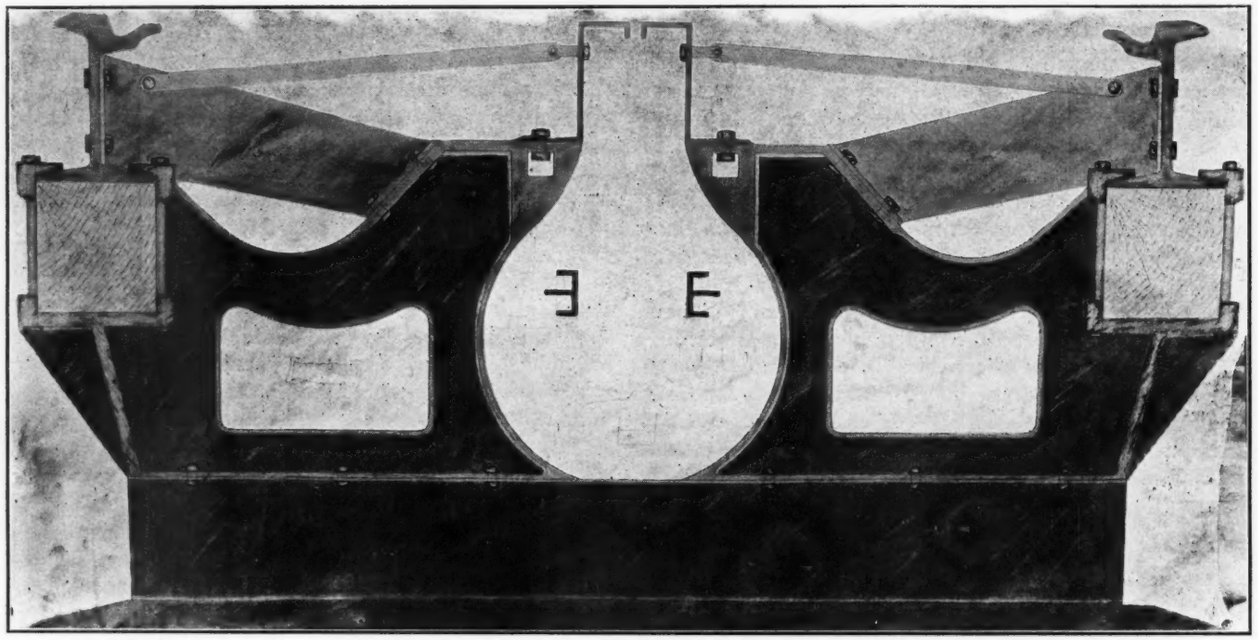
So, after all, it is the financial aspect of the problem which practically controls the entire situation; and matters which unfavorably influence the fianancial aspect are matters to which we can well afford to direct our attention.

Examination for senior mechanical draftsman is announced by the United States Civil Service Commission on January 5-6-7, 1910, to fill the position of senior draftsman in the Ordinance Bureau, Washington, D. C., and vacancies requiring similar qualifications as they may occur in the ordinance department at large throughout the United States, at salaries ranging from $1600 to $1800 per annum.

A NOVEL CONDUIT ELECTRIC RAILWAY.

In order to demonstrate the Reynolds conduit system of a three-wire transmission, as applied to street and suburban railways, a plant has been erected and is now in operation on the city block at the corner of Fourth avenue and Fulton street, San Francisco, working on about 600 feet of regulation track, with a 3½ per cent grade.

The principle upon which this system operates is in many respects similar to that of the Third-avenue and Broadway lines in New York City, but its construction cost is less because of the saving effected by using the lower voltage of a three-wire distribution system.

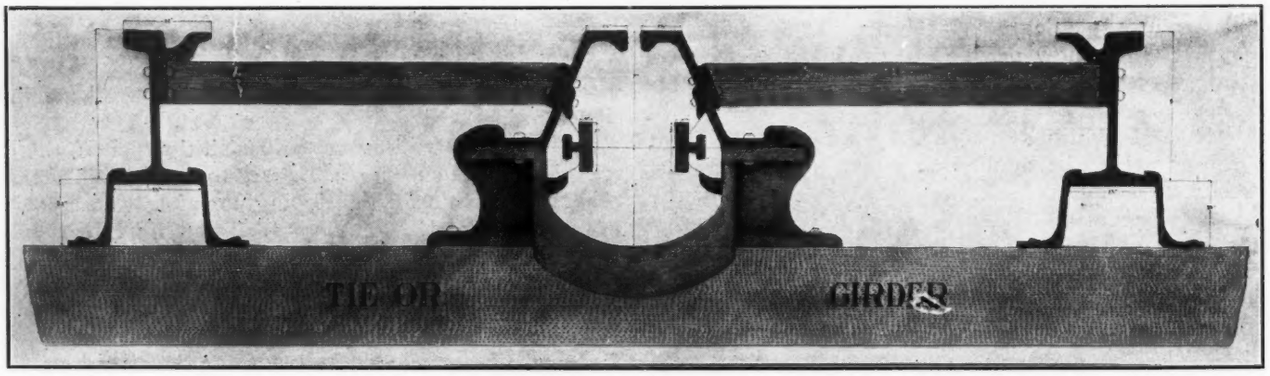


Conduit Transmission for Electric Railways, as constructed and operated on Third Avenue and Broadway, New York, and in Washington, D. C.

The New York construction as shown in the accompanying cut employs iron yokes uniting the two rails and supporting the slot irons. Spaces between the yokes are filled with concrete which is shaped to form the two sides and bottom of the conduit. Upon either side of the slot line in the conduit is a steel conductor rail of convenient shape, supported from above and well insulated. The electric generators are operated on insulated bases and the current is transmitted from one of these conductors through the motor on the car to the other conductor.

The transmission current from these conductors is by means of a so-called plow, which has one side in sliding contact with a positive conductor rail, and the other in contact with a negative conductor. The plow hangs from the car in such a way that it readily adjusts itself to any position in the slot not too far from the track center, and that it is automatically detached whenever required.

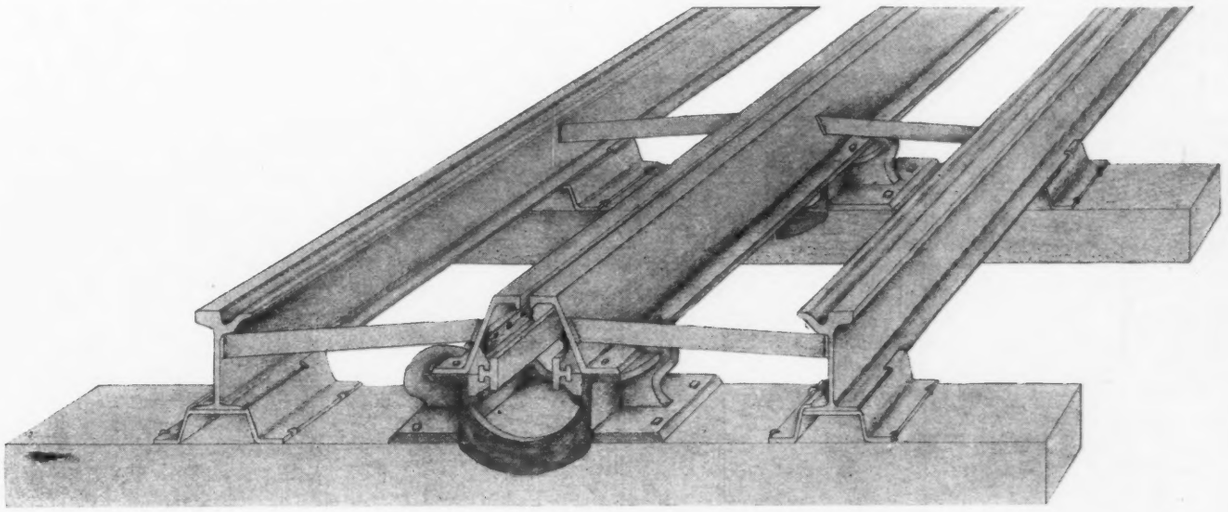
The cost of installation of this constructed is stated to range from $95,000 to $115,000 per mile. Therefore, it is concluded that only cities which are densely populated and where traffic is heavy and continuous will pay sufficient revenue to support this heavy cost. While the maintenance and operation are cheaper than in other systems, the first cost of construction is almost prohibitive.



Reynolds Conduit Transmission.

The Reynolds system uses the rails, slot and plow as in the New York and Washington systems, except that the current is divided, two generators being used.

The positive current from one generator is connected with one conductor rail, and the negative current of the other generator is connected with the other conductor rail, the slot rails acting as the neutral, being connected with the opposite pole of both generators.



Track Construction for Reynolds Conduit Transmission.

Thus each conductor rail carries one-half the voltage necessary to operate the motor to its full capacity.

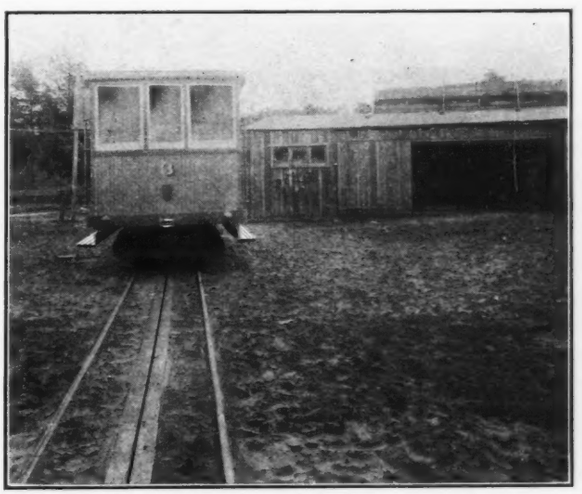
The insulation is consequently lighter, and the air space so less than that required by the older system so that the entire construction can be placed upon the ties with only 3¼ inches more excavation than is necessary to establish a surface system of any kind. The estimated saving of 1,000,000 pounds of castings and 147,000 cubic feet of concrete and excavating per mile is expected to reduce the construction cost to less than one-half of the present conduit systems and no more than the cost of the trolley system, where iron poles are used to support the wires, or the third rail when properly insulated. It also eliminates much of the damage due to electrolysis, as the current follows a continuous metallic circuit and the only loss would come through leakage, bad insulation or faulty construction.

The track construction of this system does not entail the manufacture of any new patterns of material, except the castings and insulators. The conduit construction is placed directly upon the ties, using the standard girder rail, placed upon a drop-forged chair 3¼ inches high. The conductor rails are of the section as shown upon the drawing, of approximately 32 pounds a yard. The casting is placed directly upon the tie with the web passing below the surface on the outside, and alternating. The braces are drop-forged and all of one pattern.

After the track has been properly lined and ballasted, the space to the top of the rails is then filled with concrete, basalt blocks, bituminous, or any class of pavement the city ordinances may require.

The general form of construction is identical with that now used by the trolley and third-rail systems, except the formation of the conduit and the omission of the overhead wires or the exposed high-power conductor. The conductor rails are insulated by blocks of hard, dry wood, hard rubber, or wood fibre, sawn or moulded under hydraulic pressure to an exact size and of whatever material is best adapted to the climatic conditions under which insulation may be required. The slot chamber is formed between the ties with concrete moulded to any form that may be required, and with drainage properly trapped and connected with the sewer as often as may be necessary to keep the slot chamber free from water.

Dust chambers will be installed at regular intervals to receive whatever debris may pass into the conduit through the opening; and especially constructed

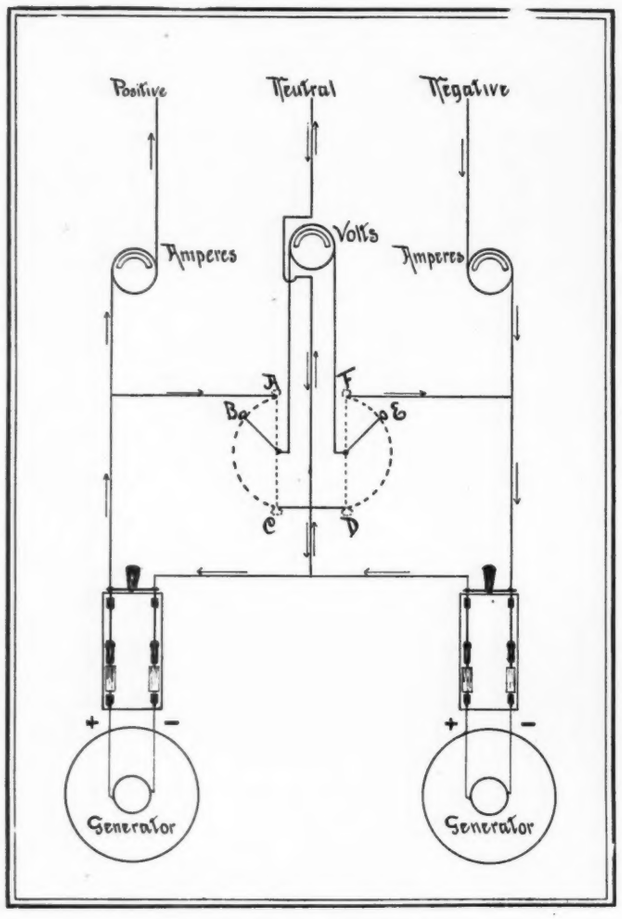


Car and Track.

brushes, passing through the conduit at regular intervals, will deposit everything in these chambers, which can be relieved whenever necessary.

The demonstrating system operates a 13-ton street car with one 500-volt series W. P. 30 motor, the electric current for which is supplied by two 220-volt d. c. Westinghouse generators compounded, directly connected with each of the conductor rails. The positive pole of one generator is connected with one of the conductor rails, and the negative pole of the other generator connected to the other conductor rail, the slot

rails being bonded and connected to the opposite pole of each generator. These generators are operated by a 50 h. p. engine belted direct. Each of the generators delivers 250 volts to each of the conductor rails, which,



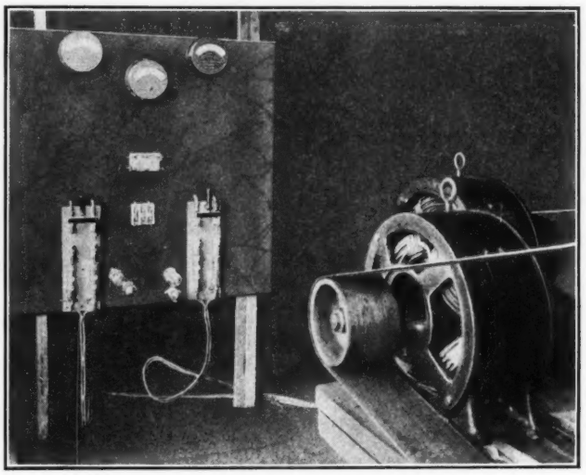
Switchboard Connections.

when the connection is established through the plow and rheostat, delivers 500 volts to the motor.

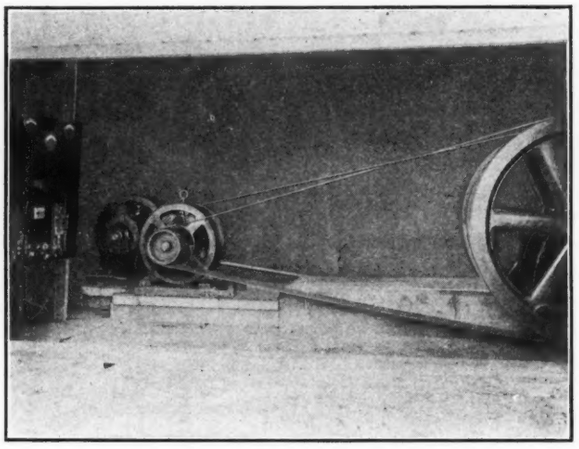
By referring to the switchboard diagram it will be seen that when switch B is connected at the point A, and switch E is connected at point D, the voltmeter will register 250 volts. Again, when switch B is connected at point C, and switch E is connected at point F, the voltmeter will register 250 volts. But, when switch B is connected at point A, and switch E is connected at point F, the voltmeter will register 500 volts, which is exactly the same connection that the plow makes when completing the circuit between the two conductor rails.

All of the exposed metal acting as a neutral, and carrying an equal current in either direction, remains inactive, and any leakage or short-circuit is returned to the generator, which insures the public from danger of contact, and property from damage by grounded high-voltage currents.

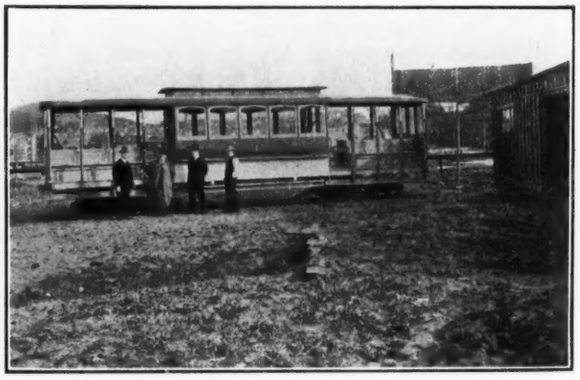
The plow is practically the same as the New York and Washington systems are now using. The top and bottom are of hardwood, so treated as to stand the dampness, with strips of steel mortised through and securely riveted. The conductors are made of layers of copper, insulated from iron and directly connected with each of the shoes. The latter are of castiron and have a gentle pressure against the conductor rails from a pliable steel spring. The shoes make a sliding contact with the conductor rails, receiving from each 250 volts, thus completing the circuit of 500 volts, which are then connected with the motor. This plow depends from the bottom of the car and is so hung that it will detach itself at any fixed point.



Switchboard.



Dynamos.



Demonstrating Car.

WRINKLES

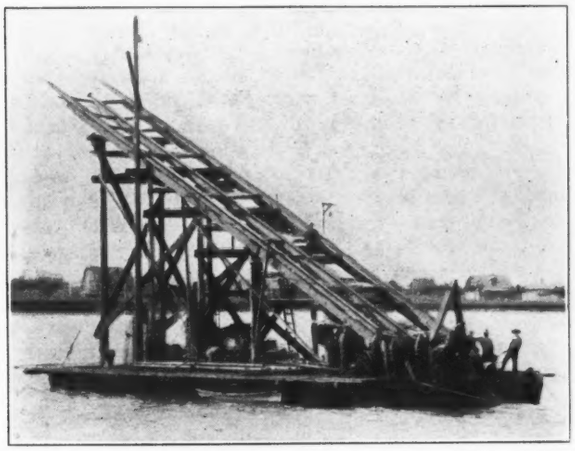
Pacific Coast Gas Association

HIGH PRESSURE SUBMARINE GAS MAIN.

BY R. L. CLARKE.

The San Diego Consolidated Gas & Electric Company, San Diego, California, were solicited very strongly to supply the City of Coronado, California, lying across the bay from San Diego, with gas. Coronado is a small town and the probable greatest number of consumers in sight was about 300, with the possibility of furnishing gas to a "Tent City" with 500 consumers or more for three months in the year.

Several propositions were proposed to supply these customers. Finally a sub-marine high pressure gas main from San Diego to Coronado was decided upon. When the capacity of this main and the necessary obstacles to be overcome were considered, two propositions were estimated upon. One—the laying of two 1½-inch heavy lead pipes across the bay in different localities to avoid the possible interruption of service from anchors of boats, these two pipes to come ashore at the same locality and to be virtually one from there on. This was finally abandoned on account of the small capacity which, while great enough for the present, would not give



Barge Laying High-Pressure Submarine Gas Main.

capacity we thought necessary during the life of the pipe.

A four-inch extra heavy cast iron ball and socket pipe was used for this work, and the danger from the pipe being broken by anchors was avoided by running to a point on the bay where the ferry crosses from San Diego to Coronado. This particular line between ferry slips is held, by the Harbor Commissioners, free from anchorage. In this locality the telephone cables also cross the bay. The distance from shore to shore is about 4000 feet; 500 feet of this amount we were able to lay during low tide. The balance was laid from a specially constructed chute on a lighter, which lighter was moved across the bay by the use of windlasses attached to anchors. These anchors were shifted periodically by a launch. The pipe used for this line was made in ordinary lengths of 12 feet with a standard joint on one end, and either a ball or socket on the opposite end—that is to say, two lengths with a standard joint put together, left a ball on one end of this 24 foot length, and a socket on the other end, thus giving a flexible joint every 24 feet. The standard joints were lightly yarned, but heavily leaded. The ball and socket were cleaned only, and the ball then placed in the socket and leaded and calked. This was all done on the lighter. in fact all of the material for this work was placed on the lighter before it was moved from the wharf. It required about two weeks to construct and arrange the chute on this lighter, the lighter being 24 feet wide by 90 feet long. The chute was built up from one end of the lighter at an angle of about 30 degrees from a horizontal.

The capstans and windlasses were fastened to the four corners of the lighter and a steam hoist was installed on the lighter for the double purpose of pulling the lighter ahead by the use of headlines and anchors, and also hoisting all of the pipe to the work benches and chute on the incline. There is a very important part of this construction that cannot be seen in the picture, as it is underneath the water. It consists of two 100-foot piles placed about four inches apart and bolted together and hinged at the upper end to supporting timbers bolted to the lighter. These piles at the lower end have a pair of iron trucks which are securely bolted to the lower side of the piles for the combined purpose of rolling on the bottom of the bay to carry the weight, and also to act as anchors that would not allow these piles and the pipe (when it was being lowered) to be swung sideways by the tide.

The line of this pipe passes across the channel of the bay, which is about 40 feet deep at this point, and the tides are very swift. At one time during the laying of this pipe, seven 800-pound anchors were required on one side of the lighter to hold it against the wind and against the tide, which were in the same direction.

Another advantage in these piles extending down to the bottom of the bay from the lighter is that, if the lighter shifted even 50 or 100 feet or twisted from the line of the shore points established, these wheels would get only a slight distance out of the true line which we wished to follow, acting like a long tail to the lighter. As proof of this, the divers reported that in no place were there any bends in this pipe, so far as they could see, that were more than 18 inches out of a straight line. It required three days to lay the pipe across the bay, and eight days at $40 per day for the divers to calk the pipe until it was absolutely tight.

The divers were employed part of the time, while we were laying the pipe, to follow the line as it was laid and watch out for any breaks or interference with any cables at present in the bay. Each time that work was ceased for the day, air pressure was applied from the shore end by plugging the end on the lighter, which proved that there were no broken lengths in the first place, and allowed the divers to see any bad leaks.

By reference to the picture, it will be seen that the chute built on the lighter was constructed of two 80-ft. piles, spaced four in. apart and bolted together, and erected on a frame work to give them the necessary angle. On each side of this piling were arranged work tables where four or six 72-ft. lengths of pipe could be made up and be in readiness to roll into the center chute at short notice, after the lighter had been moved ahead 72 ft. These lengths had the standard joints made up on the floor of the lighter, and then hoisted by the use of a steam hoist to the work tables on the chute where two ball and socket joints were made up.

After the lighter was moved ahead until only three or four feet of the pipe was above the water, another length of 72 ft. was rolled into the chute and lowered carefully into the socket. These joints were usually run and calked in from ten to fifteen minutes, when the lighter was again ready to be moved ahead.

The different angles which the piling, extending from the end of the lighter, took for the various depths of water caused considerable movement of the joints (both the ball and socket and the standard joints) during the time of laying. In fact, at some times the angles of the pipe just as it was leaving the lighter were quite sharp, but no trouble was encountered in making these joints absolutely tight later on. At several times, two or three joints would stand clear in the air not touching the chute for 30 ft. This probably could not have been handled that way, except for the extra heavy pipe, which was 25 pounds per foot, or 300 pounds per length of

12 ft. This ball and socket joint was of the class in which the lead is imbedded in the bell end and the ball end of the pipe carefully machined.

After the pipe was laid to the opposite shore, the pressure was kept on this line all day, allowing the divers to see any leaks and calk them either by hand or with an air-hammer. To use the air-hammer, a gasoline air compressor capable of delivering 80 lbs. of air was placed on board the diving outfit's lighter. This, with the necessary hose and a small calking air-hammer enabled the divers to do much more rapid work, as the air could be used to clear the sand from about the joints, and then the rapid work of the hammer completed the work quickly and solidly. Eight days was required with this diving outfit to make this pipe line tight. It was tested to 75 lbs. and dropped only 10 lbs. in twelve hours.

At the Coronado shore end a 30-gallon drip pot was installed with arrangements made for blowing the water from it by the pressure of the gas. A similar one was installed in the company's yard near the governor house. Also in this yard a steel tank 90 in. in diameter and 30 ft. long was installed for storage primarily, but with the arrangements that if any water came through with the gas, it would be separated in this tank. We have yet to get a bucket full of water out of any of these drips, which is quite a surprise to us. From the storage tank the gas is piped to a double district governor, there reduced from 20 lbs. (The pressure which we at present carry on this line) to 4 in. of water pressure, and distributed through eight miles of mains to 250 customers through 4 in. and 2 in. steel pipe. The cost of the high pressure installation was about $5800.

AN IMPROVEMENT ON HOISTS FOR FILLING PURIFIER BOXES.

BY F. C. MILLARD.

Some time ago we devised a successful scheme for converting a cement hoist into an oxide hoist, and an article was written thereon. We have now made an important improvement on this scheme and for the benefit of those who did not read our last article, we will describe the hoist again with its improvement.

We realized that it was costing us unnecessary labor and money by continuing the system that we had in vogue of filling our purifier boxes with the ordinary oxide conveyor, so we determined to find a means for cutting down this unnecessary expense.

After watching the hoists on new buildings conveying cement from the ground to the top floors, we made an examination of this hoist and found that we could adapt it to our use very nicely by making a few changes. As there are several different styles of these hoists, we investigated until we found a style that we thought would accomplish our purpose. A galvanized iron bucket hoist was selected. A steel tower was built, with adjustable clutches at the top so as to deposit the material at any point desired. This iron bucket is pulled up the tower by means of a windlass driven by a motor, and when it reaches the desired point the clutches trip it and it empties its contents into the galvanized iron chute which is placed there for that purpose. This chute is about 18 ins. deep and open on top. It runs directly into the center of the purifier house and its course may be diverted into any box desired by means of another chute attached to the first one by the help of a swing joint.

With this system it only takes about an hour to fill a box, against five hours with the old system. The life of the oxide is much longer also, as it doesn't break up into fine powder as it does when using the conveyor.

While this system was a big improvement on the old system of the conveyor, we found that we could even improve on this one. When our plant increased to such an extent that we were obliged to double our purifier capacity, and we found it imperative to install another apparatus for conveying oxide to the boxes, we had plans and specifications drawn up and put into service, another hoist similar to the one just described but having the chute made of 15 in. galvanized iron pipe and having three different stations, as it were, for the discharge of the oxide. These stations, or platforms for discharging oxide are located about one-third, halfway and nine-tenths of the way up the tower. From the nearest platform we have pipe running to the nearest boxes to the tower. At the second platform the pipe runs to the middle boxes, while at the top platform the pipe runs to the boxes furthest away from the tower. By this improvement it is possible to have a pipe run directly from the discharge platform to each and every box, instead of having one chute for the whole set of boxes. We also find that by having the 15 in. pipe instead of the chute, there is no loss of oxide from the wind blowing it out.

USE OF GAS WATER HEATERS TO OBTAIN HOT WATER INSTANTANEOUSLY.

BY C. L. WIGHT.

Allow me to contribute the following to "Wrinkles," viz: The use of gas water heaters of the ordinary type to obtain hot water instantaneously without the water boiler heretofore considered necessary. These heaters can be set up in the kitchen with connections direct to the sink, bath tub, etc., or in a bath room as a substitute for the more expensive nickel plated heaters.

The objection will at once be raised that if the water boiler be eliminated, the heater will be liable to explode if the water outlet be closed while gas is turned on. One need have no fear as to this point. As soon as steam begins to form, the water hammer calls attention to the heater at once, but if any member of the association is skeptical as to this point it will be a very easy matter for him to fit a cock to the water outlet and experiment for himself, leaving the gas lighted—say, for half an hour. It is necessary, however, that the water be not shut off before it comes to the heater, and the only trouble we have experienced has been due to this cause, and out of over one hundred heaters that have been in use for over a year, we have only had three complaints, and as we are careful to notify consumers to be sure that water can reach the heater at all times, there was no kick in these cases.

While any heater may be used for this purpose, we have secured the best results from one having a double copper coil close wound.

We have had many complaints from consumers using nickel plated heaters that the water was sooty. This was caused by down draft. In some cases we could overcome this difficulty by placing down-draft hoods immediately over the heaters. In other cases, we have had complaints with heaters of this class that the water was green. Where these evils could not be remedied, we have substituted the heaters above described, and in no case has there been any further complaint.

One of the great advantages of using this class of heater for instantaneous work is the fact that the coil and burner are accessible so that the consumer can clean the same himself without expense.

Before we fitted up heaters in this way, consumers were constantly complaining about their gas bills. Further, we found it difficult to sell gas ranges to replace coal and wood stoves because it cost so much for hot water. Since making the change to direct connected heaters, we have doubled our sale of ranges, and we are now selling five heaters where we only sold one before.

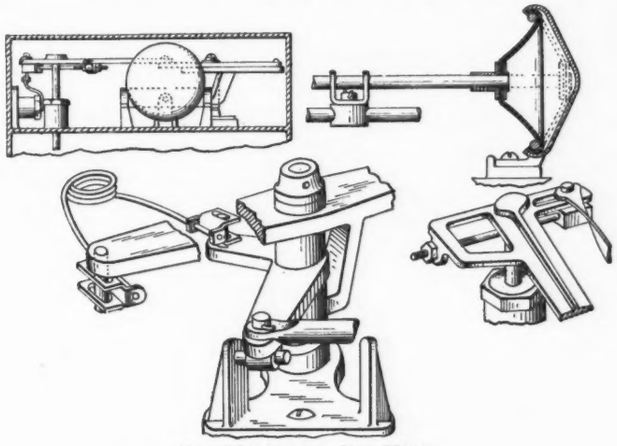
The bath tub is raised 18 in. above the floor so that the water can be reached without stooping. The gas pipe is connected to a meter reading at one hundredths of a foot so that a customer can see at a glance just how much gas will be required to heat a tub of water.

Consumers can thus see that our statement that—a bath costs from three to four cents with $1.50 gas—is correct. Further, where a consumer does not understand the use of a heater or has any trouble, it is very easy to locate the cause. Since making this change, our complaints as to water heaters have practically ceased, and our business has increased materially.

NEW ONE DIAPHRAGM GAS METER.

BY WM. SCHADE.

This new one diaphragm gas meter is built like any other square tin gas meter now in use, with the exception of having but one diaphragm and one valve; neither are there any tubes on either side, nor is the valve concealed in a separate box in the gallery. The inlet and outlet are simply short connections on top of the meter, the inlet conveying the gas into the gallery, from whence it is conducted through the valve into the lower section of the meter to both sides of the diaphragm, thus filling the entire meter above and below with gas. The outlet reaches just through the gallery floor and conveys the measured gas into the housepipe. It will thus be seen that the diaphragm measures the gas both ways: first, in filling the inside of the diaphragm, it, at the same time by moving to the front, displaces exactly the same amount it takes in. This is continually repeated as the diaphragm moves back and forth, but, unlike the present style of meters, where the valves are controlled by the diaphragms, in the meter the diaphragm is controlled by the valve, which, as will be seen by the accompanying drawing, is operated by a



One-Diaphragm Gas Meter.

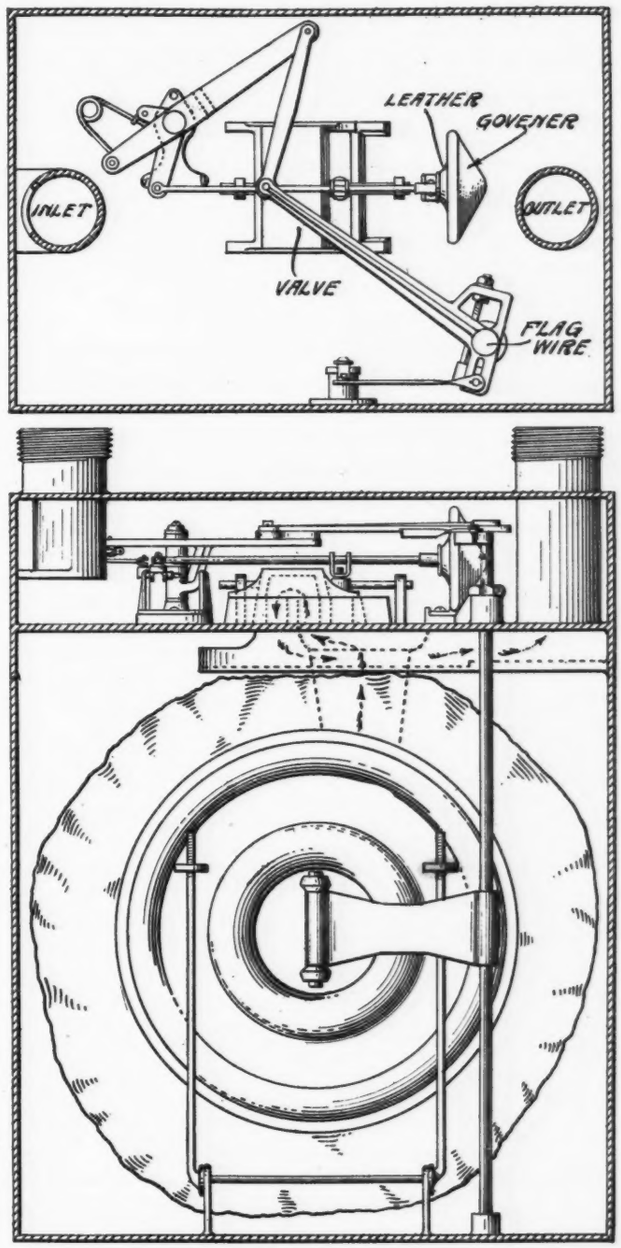
coil spring made of phosphor bronze wire, consequently noncorrosive and practically indestructible, and which, every time it passes the center line, throws the valve first one way and then the other, thus allowing just so much gas to pass through the open port while the other is closed. No more pressure is required to operate this meter than any other—about 2/10 inch.

The spring, as stated before, is practically indestructible, because the little tension required in the operation is distributed over the whole coil, not affecting any one place in particular, thus absolutely preventing crystallization of the wire.

A governor is also shown in the drawings, which is a simple affair, consisting of a little tin cup covered with leather and operating like a diaphragm. It has a very small hole in the back of it, allowing just enough gas to escape to prevent rebounding. In the other direction it works against the pressure of the gas in the gallery, thus allowing the valve to move free and easy, at the same time preventing any possible jar.

The model displayed in operation before the Pacific Coast Gas Association was the size of an ordinary five-light meter, having a capacity of about 300 ft. per hour; thirty 7-ft. tips were attached to the meter, and as many more could easily have been supplied under the pressure we had, without crowding the meter. The meter has, therefore, the following advantages: It has but one diaphragm and one valve, and this valve is not concealed in a separate box in the gallery, as in the present style of meters, consequently, we save: first, one diaphragm; second, the partition which divides the diaphragms in the meters now in use; third, the box which conceals the valve; and, fourth, the tubes which run down on either side of the meter.

A conservative estimate will reduce the cost of construction of the same sized meter about $1.50. Add to this



One-Diaphragm Gas Meter.

the difference in capacity from possibly 80 ft. to about 300 ft., then consider the price of a twenty-light meter, and you cannot fail to see the enormous saving of money. Add to this the cost of repairs, which I firmly believe is less than one-half that of any other meter, because all that is necessary in case of repairs is to remove the top and the front, and the entire inside is exposed and accessible to the mechanic, while at the present time the entire meter has to be dismantled in order to get at every piece, and the more pieces there are

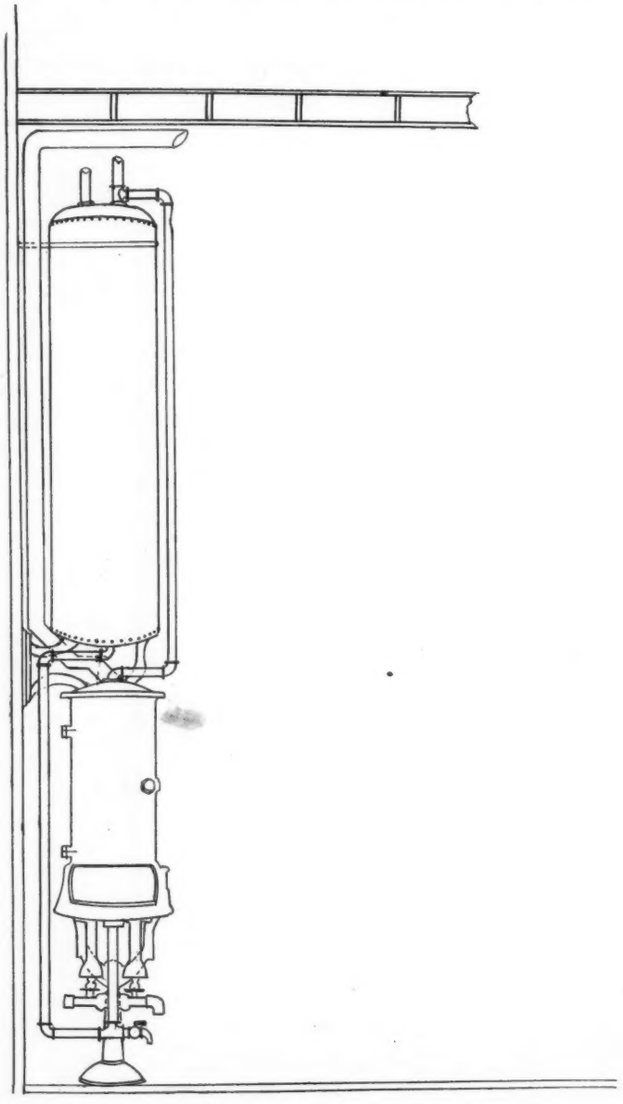
in a meter the more liable it is to get out of order. That stands to reason; with the new meter no waste of labor is necessary.

The object of this invention was to simplify the meter, reduce the cost of construction, and quadruple the capacity. At the present time we have about nine different sizes of meters to reach a 100-light capacity, while with this meter only four sizes are necessary to reach the same results.

INDEPENDENT WATER HEATER.

BY C. H. HURT.

This wrinkle is intended to show how an independent water heater can be used in close quarters in many apartment houses being built at present. Space is an object as the diagram will show. The tank and independent water heater may be set in the corner of the room, and will not



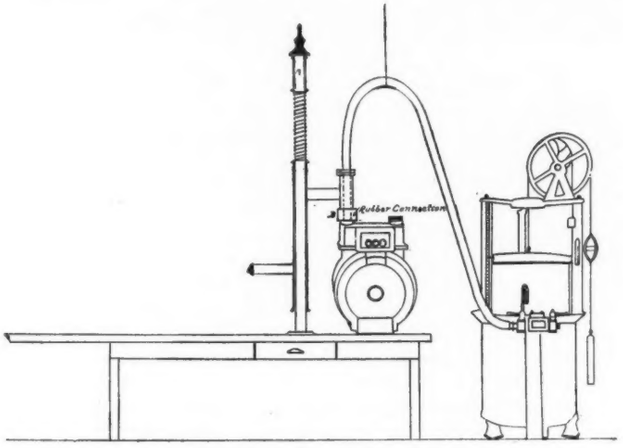
Independent Water Heater.

occupy to exceed 16 in. of space. This diagram is explanatory within itself. The water heater will show a greater efficiency than it would if connected at the side of the tank. The vent pipe will lead to the back of the tank, and will not be exposed to view. The idea is to economize space in using an independent water heater with a 20 or 30 gallon tank, so as not to occupy any more space than the combination water heater and tank.

AN ADJUSTABLE METER PROVER CONNECTION.

BY A. P. HENNING.

An adjustable meter prover connection. It is quick and easily adjusted for any size meter without any additional connections. Give lock nipple "A" a one-quarter turn to the right; then raise or lower same until the proper tension of



Adjustable Meter Prover Connection.

the spring is secured to make a tight joint at "b," which is a thick rubber gasket. Then turn "a" back to its original position. The same adjustment will do for the larger size meter. Any size from a No. 1 Sprague to a 20-light tin meter can be proved with this size connection.

SAN FRANCISCO'S NEW ELECTRICAL ORDINANCE.

To the Editor:—We are enclosing herewith an ordinance covering the regulation of wiring in the buildings within the fire limits of this city. This ordinance was framed by the Electrical Contractors' Association, the writer as chairman of the committee handling the same.

You will note that the intention is to raise the standard of electrical wiring in this city, in that it provides for protecting all wires by means of steel conduit or other suitable armor. At the present state of affairs, San Francisco is somewhat behind the times in regard to electrical installations, compared with such cities as Atlanta, Philadelphia, Chicago, Boston, New York, Minneapolis and Spokane. All of these cities have for a long time enforced the installations of wires in conduits within the fire limits, and it is certainly a Godsend that the old knob and tube system is to be abandoned with its well known fire hazards.

PAUL C. BUTTE.

Ordinance regulating the installation and maintenance of wires used for the carriage of electricity for light, power, telephone, telegraph, messenger, or signal service, installed in buildings within the fire limits of the City and County of San Francisco.

Be it ordained by the People of the City and County of San Francisco as follows:

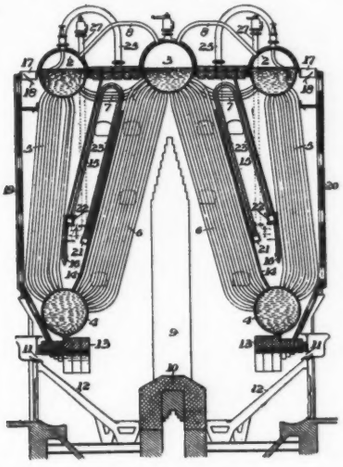
Section 1. All wires hereafter installed in or on buildings or other structures within the fire limits of the City and County of San Francisco, and used for conducting electricity, shall be enclosed as thus installed in "National Code Conduit," or other approved armored conductors; provided, however, that such wires when used for telephone, telegraph, district messenger, call bells, or similar systems, are exempted from the foregoing provisions.

Section 2. This ordinance shall not prohibit temporary installations of other methods of electrical construction for decorative or display purposes, and the Department of Electricity is authorized to grant special permission for such temporary installations for a period not to exceed sixty (60) days.

Section 3. Any person, firm or corporation, at any time installing wires in violation of the provisions of the foregoing sections shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not to exceed five hundred dollars.

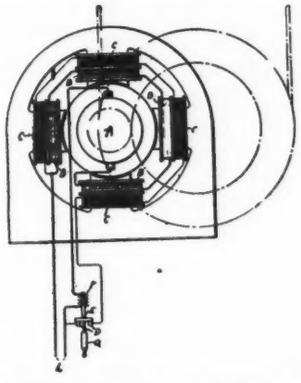
PATENTS

942,797. Water-Tube Boiler. James P. Sneddon, Barberton, Ohio, assignor to The Babcock & Wilcox Company, New York, N. Y. A water tube boiler of the A-shaped type having firing openings at both front and rear, a central primary



combustion chamber with which both firing openings communicate, a pair of lower mud drums, a plurality of upper steam and water drums, banks of tubes connecting the drums, and baffles arranged between the banks of tubes.

942,463. Method of and Means for Regulating the Speed of Electric Motors. Robert H. Rogers, Schenectady, N. Y., assignor to General Electric Company. The method of regulating the speed of an electric motor having a shunt and series

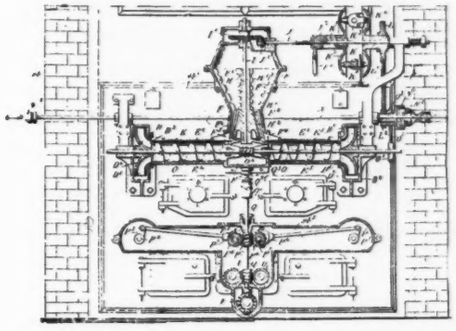


field winding, which consists in operating said motor as a series motor when under lead and as a cumulative compound motor when lightly loaded.

942,248. Automatic Self-Indicating Fuse. Frank B. Cook, Chicago, Ill. A fuse of the character described having a casing for the fusible conductor and metallic end caps on the casing, at least one of the end caps having a hollow outwardly-projecting hub thereon, a metallic plunger carried within the

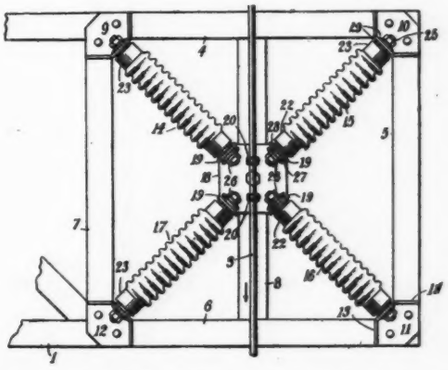
said hub and movable therein, a coil spring encircling the said plunger and being conductively attached to the latter and to the said hub, and a fusible conductor extending through the said casing and through the said plunger and being attached to the outer end of the latter, the said fusible conductor being normally under tension whereby the coil spring is held under compression to normally hold the said plunger down into the said hub, the fusing of the fusible conductor releasing the said coil spring and thereby permitting same to extend itself and thus move the said plunger outwardly, relatively to the said hub.

942,060. Mechanical Stoker. Thaddious V. Elliott, New York, N. Y. In a mechanical stoker for a furnace, a fire box having a grate provided with grate bars mounted to rock, a feeding device for feeding fuel into the fire box and comprising a screw conveyor and a shaft for the same, an ash



remover, a vertical shaft, means for actuating the grate bars and the ash remover from said vertical shaft, a second vertical shaft driven from the shaft of the conveyor, a clutch connection between the vertical shafts, and means for actuating the conveyor.

942,335. Insulating-Support for High-Tension Conductors. Ralph D. Mershon, New York, N. Y. An insulating support for high tension conductors, comprising a framed structure having insulating structural members for resolving mechan-



ical forces originating in the conductor into components, conductor-carrying means, and connections between the said means and the said insulating members, constructed to transmit to the respective members substantially only forces in one direction.

942,213. Fuel Composition and Method of Producing the Same. Lyman R. Palmer, Los Angeles, Cal. A fuel briquet composed of the admixture of 85 parts of pulverized coal or other carbonaceous material, 15 parts of asphaltum, 5 parts of pitch submitted to a temperature of 400 degrees Fahrenheit until liquefied, fluxed by the injection of three per cent of melted grease, and formed into blocks.

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As another year nears its close, we take pleasure in repeating the immutable message of the Christmas spirit, "Peace on earth, good will towards men," likewise in wishing all our readers a "Merry Christmas." Electricity is anually becoming a more important factor in the observance of this festival of light and electrical devices are finding ever increasing favor as Christmas gifts. This augurs well for the happiness and prosperity of the coming year for those in the electrical industry.

Senator Newlands of Nevada is quoted as saying: "If the President should conclude that the best interests of the reclamation project require that the proposed co-operative contract (between the Reclamation Service and the California-Nevada Power Company) should be approved and the protection of the public against extortionate charges by conditions in the license granted is not within the power or is no concern of the National Government, then it may be necessary for the State of Nevada to organize a Public Service Commission with power to control capitalization and charges."

The question of damage to lighting circuits by wireless telegraph enthusiasts has been satisfactorily solved in Oakland, California, by installing separate transformers for this class of service. There is probably no branch of electricity that has so facinated the amateur as wireless telegraphy. This interest is commendable so long as it does not interfere with the rights and comforts of others, but in many communities it has become a nuisance. This is particularly true in the coast towns where amateur operations frequently make commercial and governmental communication impossible. It is hoped that the boys will realize that they are only on sufferance and that they should so conduct their experiments as to make no drastic governmental regulations necessary.

At this time of the year few consumers are registering complaints because of the dollar monthly minimum charge for electric meters. None the less interesting, however, is the recent decision of the Massachusetts Gas and Electric Commissioners that this charge is justifiable, in that it compensates for the actual cost of maintaining the meter and the investment it represents. The defendant company brought facts to show that it requires forty kilowatt hours yearly to excite the shunt coil as long as it is connected to the lines. The Commission suggests that one dollar per month be the greatest charge and recommends a smaller amount. The decision takes no cognizance of the fact that the electric company has a large investment in a generating plant designed to meet the maximum demand of the consumer. Some people object to the American plan of conducting a hotel whereby a charge is made for meals not eaten

during the guest's stay. It is argued by the hotel management that the expense of preparing the food exists, even if it is not eaten. The fixed expenses of an electric power plant that stands ready to furnish current at any time are analogous.

Work for the Geologist

In reading the article on "Oregon Power Sites" the hydraulic engineer may question the need for such an exhaustive geological study as is here detailed before locating a dam site, but when we consider the hazard involved in placing a dam or power house on uncertain foundations, we cannot but realize the necessity for such careful preliminary examination as will insure its subsequent stability. The biblical "house built on the sands" could never be subjected to so many vicissitudes and inclemencies as is a great dam that forms the only restraint to the tremendous force of pent water.

The region described in the article has been subjected to the vagaries of volcanic caprice. Made up of great sheets of lava, which are separated by beds of scoria and breccia, the surrounding earth is as likely to give way as is the dam. Land slides have occurred and are likely to again occur in the future. The rock is porous and gives easy passage to water that should be stored for summer need. More water may seep under and around a structure than can be retained by adding ten feet to its height. These are conditions that any but a trained observer would be liable to overlook. Even core-drilling does not always show them. One man can see no further into the earth than another, but it takes a geologist to clearly interpret what is seen.

Financing Water Power

Heretofore it has not always been an easy task to induce capital to invest in the development of hydroelectric power. The initial outlay is indeterminate, the money lies idle for a long time; the returns are but moderate, and recently the antagonistic attitude of the government has been deterrent. In consequence, it is only the most courageous who have dared to assume the risk,—and won. Electric power, water generated, is yet young. There is little doubt but that by the time it has attained the present age of the gas interests it will be even more strongly intrenched in financial favor. When men of such business ability as Henry Doherty place themselves on record as in the paper read before the American Institute of Electrical Engineers this week, the stability of this form of investment is evident.

In the extract from the paper published elsewhere in this issue, Mr. Doherty treats the subject from the financial standpoint. But the major part of his paper, as read before the Institute, consists of a series of suggestions whereby hydroelectric service may be improved. These may be broadly classified under three heads: power interruptions, power marketing, and cost estimating.

A system for the long distance transmission of hydroelectric power is like a chain, in that it can be no stronger than the weakest link. The first requisite is continuity of service. The author summarizes the various methods and equipments by which interruptions may be minimized and finally concludes in favor of the steam turbine as a necessary reserve. He also takes up the question of penalty to be paid by the hydroelectric supply company in case of interruption to service. It seems no more than right where these penalties are exacted, there should be a corresponding bonus for continuity of service. If by any fortuitous circumstance it has not been necessary to operate the apparatus held in reserve to meet the possible emergency, there should be some compensation for the reliability of service given.

These proposals show the economic advantages of centralization of power supplied by tying in not only a number of power plants, but also a number of power systems. There is probably no better exemplification of what may be done in this direction than is shown in the electric supply to the city of San Francisco. Primarily supplied from the plants controlled by the Pacific Gas & Electric Company, power is obtained from physical connection with the lines of the Northern California Power Company, The Great Western Power Company and the Stanislaus Power Company. These are independent concerns, but at times of need their plants and lines can be put at the service of one another.

In marketing any commodity it is necessary to take into consideration its price, its buyers and its future development. In marketing electric power, there are almost as many methods of charging as there are companies. In this paper emphasis is laid upon the advisability of basing the charge, not only upon the amount of current consumed, but also upon the "maximum capacity demanded by each consumer at the time of maximum simultaneous peak on the station and transmission lines." Advantage should also be taken of the opportunity to improve the load factor by securing a diversity of consumers. As to future needs it is here contended that they should be considered in the initial estimates, as should also the calculations as to depreciation.

Under the subject of cost estimating it is suggested that independent preliminary reports be submitted by two or more sets of engineers, a comparison of which will prove an ample check for omissions and mistakes in calculation.

Taken in its entirety this paper is a notable contribution to the subject not so much from what it states as from what it suggests. By inaugurating a campaign that will bring to public attention the value of hydroelectric securities, and obtain from public officials proper consideration of water power development. Mr. Doherty has rendered signal service to the industry. The force of his suggestions produce the energy of faith among engineers, investors, and others that is necessary to counteract the present opposing power of public opinion.

PERSONALS.

W. E. Cooke of the Automatic Telephone Co. of Chicago is in San Francisco this week.

H. R. Noack of Pierson, Roeding & Co., has returned to San Francisco from the East.

J. R. McKee, chairman of the sales committee of the General Electric Company was a recent visitor in San Francisco.

W. J. Foster, designing engineer with the General Electric Company, is visiting Portland and Seattle while returning East from San Francisco.

Arthur S. Merrill of the Chicago Fuse Wire & Manufacturing Company, visited San Francisco this week on his annual trip to the Pacific Coast.

G. A. Knoche has resigned his position in charge of the electrical department of Dunham, Carrigan & Co. of San Francisco and will go East about January 1, 1910.

M. F. Steel, formerly with the California Electrical Construction Co., has joined the Pacific Coast sales force of the Holophane Company at the San Francisco office.

N. E. Rechnieuski, engineer of the French Thomson-Houston Company, visited San Francisco this week in the course of a tour of inspection of American electrical practice.

C. W. Burkett of the Pacific Telephone & Telegraph Company, has returned to San Francisco after an arduous trip of inspection over the new lines being constructed by the company in Southern California.

P. J. Murphy has resigned as superintendent of power stations of the Coney Island & Brooklyn Railroad, Brooklyn, N. Y., to take charge of construction work in San Francisco for Ford, Bacon & Davis, New York, N. Y., in connection with a contract which that firm has with the United Railroads of San Francisco.

TRADE NOTES.

The contract for two 3000 h. p. Pelton impulse water wheel units has recently been placed by the Leheigh Valley Portland Cement Company of Allentown, Pa. Each main Pelton unit will be of the "double overhung type" and develop a maximum of 300 h. p. at 360 r. p. m. Alternators are of the Westinghouse manufacture and their rotating portions will be carried between each water wheel, the latter being arranged in batteries of two.

Ultimately the plant will consist of five generator units. The contract calls for two 200 h. p. Pelton exciter water wheels, each exciter possessing sufficient capacity to energize the five units when ultimately installed. The available water head is 450 feet and the water will be distributed to the wheel units by means of a 72-inch receiver tapering to 46 inches. The entire output from the station will be used for the large cement plant located near the Pend Oreille River, Wash. The entire hydraulic equipment together with the oil pressure governors will be built in the San Francisco shops of the Pelton Water Wheel Company.

The Parker-Clark Electric Company announces the retirement of Mr. W. G. Clark from his connection with the company and the election of Dr. George N. Miller to the office of president and director. In order to be in close touch with their laboratories, the offices of the company have been moved from the Singer Building to the Lincoln Square Building, 1966 Broadway. Prof. H. C. Parker continues at the head of the laboratory work and, with the advent of Dr. Miller as the chief executive, active preparations are being made to at once place the Company's products on the market. These include the Helion resistors, the Helion incandescent, and the Helion naval lamp, which will stand the shock of firing large guns on board men-of-war.

ORGANIZATION OF SAN FRANCISCO ELECTRICAL MANUFACTURERS.

The Electric Manufacturers' Branch of the California Metal Trades Association was recently organized and has been officered with a craft committee composed of Messrs. H. T. Adams of the Farnsworth Electriral Works; A. E. Drendell, of the Drendell Electric & Manufacturing Company, and S. H. Weidenthal, of the Weidenthal-Gosliner Electric Works. A list of C. M. T. A. members identified with this branch here follows:

John G. Sutton & Co., Pacific Electric Motor Co., Anderson Electric Works, Butte Engineering Co., Drendell Electric & Manufacturing Co., Electric Manufacturing Co., Inc., Enterprise Electric Works, Farnsworth Electrical Works, Pacific Motor & Engineering Co., San Francisco Engineering Co., Weidenthal-Gosliner Electric Works, Union Iron Works Co., Herzog & Dahl, Marine Electric Company. The California Metal Trades Association is an employers' protective organization having as its objects, to secure and to preserve equitable conditions in the workshops of its members whereby the interests of both the employer and the employee shall be properly protected, and the investigation and adjustment of any question arising between members and their employees which may be referred to, and come within, the jurisdiction of the association.

LOS ANGELES ELECTRICAL LUNCH CLUB.

At the regular monthly meeting of the Electrical Lunch Club of Los Angeles held December 9, 1909, Mr. Willis Booth, president of the Chamber of Commerce made a very able and entertaining address on co-operation, using as his theme the relations between the lighting companies of this city and the proposed municipal plant to be built on the line of the aqueduct. Mr. Booth urged the members of the electrical fraternity to assist the Chamber of Commerce and the Merchants' and Manufacturers' Association in their endeavor to secure a favorable vote on the $3,500,000 bond issue upon which the people will be asked to vote in about a month. This money is to be expended in preliminary work for the erection of the municipal plant.

Mr. Booth claims there is room for all and with the entrance of a municipal lighting company, it was not the intention on the part of the city to force the rates so low that operation on the part of the present electrical companies would be made at a loss and recognized the fact that their investments must be protected, because, on account of the rapid growth of the city, that part which the municipal plant would play in the electrical field, would ultimately be the small end and in order to command capital for the continuance of the electrical industries, the rate must be left on a fair and just basis.

Mr. Booth stated further that it was up to the men interested in the electrical business who understand the practical end, to enlighten the uninitiated on the subject and then continue the campaign as the future of the city depends on the available power and at a reasonable cost. Mr. Booth's remarks were well received and he was assured that civic pride, co-operating with business judgment, would compel the assistance of every member of the club and that the proposed election on the bonds would undoubtedly result favorably.

The meeting was well attended, there being 73 present and Secretary Clapp reported a paid membership of 140, representing every branch of the electrical industry. The club meets the second Thursday of each month in the Sons of Jove room at the Hollenbeck Hotel at 12:15 o'clock. All visiting electrical men are cordially invited.

NEWS OF THE STATIONARY ENGINEERS

PREAMBLE.—This Association shall at no time be used for the furtherance of strikes, or for the purpose of interfering in any way between its members and their employers in regard to wages; recognizing the identity of interests between employer and employe, and not countenancing any project or enterprise that will interfere with perfect harmony between them.

Neither shall it be used for political or religious purposes. Its meetings shall be devoted to the business of the Association, and at all times preference shall be given to the education of engineers, and to securing the enactment of engineers' license laws in order to prevent the destruction of life and property in the generation and transmission of steam as a motive power.

California.

No. 1. San Francisco, Thursday, 172 Golden Gate Ave. Pres., P. L. Ennor. Sec., Herman Noethig, 816 York St.

No. 2. Los Angeles. Friday, Eagles' Hall, 116½ E. Third St. Pres., J. F. Connell. Fin. Sec., Harry Notthoff, 1307 Winfield St. Cor. Sec., W. T. W. Curl, 4103 Dalton Ave.

No. 3. San Francisco. Wednesday, Merchants' Exchange Bldg. Sec., David Thomas, 914 O'Farrell St.

No. 5. Santa Barbara. Geo. W. Stevens, 2417 Fletcher Ave., R. R. No. 2.

No. 6. San Jose. Wednesday. Pres., W. A. Wilson, Sec., Lea Davis, 350 N. 9th St.

No. 7. Fresno. Pres., A. G. Rose. Sec., E. F. Fitzgerald, Box 651.

No. 8. Stockton. Thursday, Masonic Hall. Sec., S. Bunch, 626 E. Channel St. Pres., H. Eberhard.

Oregon.

No. 1. Portland. Wednesday, J. D. Asher, Portland Hotel. Pres., B. W. Slocum.

No. 2. Salem. A. L. Brown, Box 166.

Washington.

No. 2. Tacoma. Friday, 913½ Tacoma Ave. Pres., Geo. E. Bowman. Sec., Thos. L. Keeley, 3727 Ferdinand St., N., Whitworth Sta.

No. 4. Spokane. Tuesday. Pres., Frank Teed. Sec., J. Thos. Greeley, 0601½ Cincinnati St.

No. 6. Seattle. Saturday, 1420 2d Ave. Pres., H. R. Leigh. Sec., J. C. Miller, 1600 Yesler Way.

Practical letters from engineers and news items of general interest are always welcome. Write your items regardless of style. Communications should be addressed to the Steam Engineering Editor.

THE COMBUSTION OF SMOKY FUELS.[1]

By Walter T. Ray and Harry Kreisinger.

Time is an important element in the combustion of fuels. The combustion of coal in a boiler furnace is a chemical process in which the oxygen reacts with the carbon and the latter's various combinations with hydrogen. This reaction, being between the gaseous oxygen on one side and gaseous, "liquid," and solid combustibles on the other, is very complicated.

The word "liquid" as used in this discussion denotes all the forms of combustible between gaseous and solid; that is, such substances as in a strict physical sense are not gases or solids. For example, if we pour some coal tar in its viscous semi-liquid form into a hot coal fire, a very dense brown "smoke" will issue from it. We know that this smoke is not gas; it is also hard for us to believe that all this smoke would consist of tiny, angular pieces of solid carbon. It is perhaps easier to think that at least a part of the smoke is composed of minute globules of the tar which have been boiled off, somewhat like the visible "steam" coming out of boiling water. For lack of better expression, we say that the combustible in the globules is in "liquid" form.

When in the use of a hand-fired furnace a fresh charge of soft coal is spread over the hot fuel bed, the coal is heated up very rapidly and part of the combustible matter is boiled or distilled off immediately after the coal reaches the fuel bed. This combustible which is distilled off is perhaps mostly in the form of gases and such forms as are here called "liquids." There are also numerous tiny pieces of solid fuel in the form of lampblack and even pieces of coal carried along with the gases. The combustible left on the grate is the "fixed carbon" in solid form, which burns there. The gaseous combustible which has been distilled off is free hydrogen, carbon monoxide, and some of the lighter hydrocarbons. The "liquids" are heavy hydro-carbons and carbon-hydrogen compounds of the benzine series, which, although surrounded by gases at a high furnace temperature, may exist as minute tar globules. It is these globules of tars which greatly add to the apparent brown smoky color of the gases. All of these forms of combustible driven off from the fuel bed are in more or less perfect mechanical mixture with the air, with the already-formed carbon dioxide, and with the water vapor resulting from evaporating the moisture in the coal, and from the combustion of part of the free hydrogen. The velocity of chemical reaction (combination) between the combustible gas and the free oxygen (or the rapidity with which the combustible gas burns) depends upon the concentration of the two gases; that is, the rapidity of combustion will be the product of the amount of free oxygen times some power of the amount of combustible gas present in a unit of volume. The combination of simple gases, such as hydrogen and carbon monoxide, perhaps consist of a single reaction, while the combustion of the unsaturated hydrocarbons, as ethylene, and aceteylene may be series of two or three, or even more, reactions, the first reactions of each series partly burning the gases and partly reducing them to simple combustibles, either gaseous or solid. Ordinarily, the velocity of these reactions or the rapidity of burning gaseous combustible is high, so that with any reasonable amount of oxygen this combustion is nearly complete in a fraction of a second. The tar vapors, however, being partly in "liquid" form, require, even in the case of a uniform mixture with oxygen, a much longer time for their complete combustion, because oxygen can act only on the surface of each minute globule. As each globule burns, an insulating film of the products of combustion is formed around it, preventing contact with more oxygen. The globules are carried in the current of gas, and since they have very nearly the same velocity, there is little or no friction between the gas stream and the globules. The chief way in which the insulating film around each globule can be dispersed and more oxygen brought into contact with the surface of the globule is by natural diffusion between the gas comprising the film and the free oxygen outside the film. This process of natural diffusion is rather slow, and as each globule contains many times more combustible matter than a like volume of gas, the process of oxidation of the globules of tar may extend over a considerable length of time, during which they may be carried out of the furnace and cooled below their ignition point. Such unoxidized tar globules appear at the top of the stack as dark smoke, and probably form the greater part of the loss in incomplete combustion.

These tar globules are similar in character to tobacco smoke, which is not a product of combustion, but a product of decomposition; it is not a slightly colored gas, but a large number of tobacco-oil globules held in suspension by the current of gas. Every smoker knows that if he pass the smoke from his cigar through a clean, white linen cloth, the visible smoke which consists of the tobacco-oil globules will condense and leave a light-brown oil spot on the linen, having a very strong, characteristic smell. The tarry globules escaping from a coal fire, if collected and condensed in some such way, generally appear as a thick, black pasty liquid, having the strong coal-tar odor, which we are accustomed to smell around a certain class of gas producers or around gas works. Tar vapors from a wood fire have a different odor than those coming from a coal fire. In fact, every fuel gives off tar vapors with odors peculiar to that fuel and somewhat different from those of any other.

In the case of a boiler furnace, any attempt to determine the tar loss by volumetric chemical analysis of the flue gases must necessarily fail, because these tars have comparatively little volume; furthermore, they generally condense in the gas-sampling apparatus.

The slow combustion of the tar globules can be made faster by increasing the rate of diffusion of the film of products of combustion enveloping the globule. This can be done

[1] Extract from Bulletin 403, U. S. Geological Survey.

by creating a relative velocity between the gas stream and the globules; that is, by making one move faster than the other or by changing slightly the direction of the main stream of gas. The resulting friction facilitates diffusion by a process of scrubbing, which removes from the globules the insulating film of products of combustion. Insertion of brick piers in the path of the gases or changing the cross section of the gas passages so that the gases have to contract and expand perhaps induces such relative difference of velocities.

That some such film as is herein described does prevent the free oxygen from coming into contact with the surface of the globules seems to be certain from the fact that gas samples taken by water-jacketed samplers from a stream of gas apparently rich in the tar vapors show usually several per cent of free oxygen.

What has been said about the slow combustion of the tars is perhaps in an intensified degree true of the small particles of solid combustible held in suspension by the gases.

By far the larger part of the coal burns on the grate, where the combustion is mostly a reaction between the solid carbon, and gaseous oxygen. The rate of formation of CO_2 seems to vary directly with the velocity of the free oxygen passing over the surfaces of the pieces of solid carbon. The higher the blast of air passing through the fuel bed of burning carbon the faster the latter burns, the chemical composition of the products of combustion remaining about the same. Undoubtedly the scrubbing action of the blast of air removes from the surfaces of the solid carbon the film of the products of combustion and facilitates the access of free oxygen. If the fuel bed is not carried too thick, very good combustion of the fixed carbon is obtained without any difficulty.

In the preceding discussion of the combustion of the various forms of combustibles in a boiler furnace it has been shown that the gaseous combustible is easy to burn because it burns quickly, and that the fixed carbon is easy to burn because it stays on the grate until completely burned; also, that the tar vapors, the lampblack, and the tiny pieces of coal held in suspension by the gases are difficult to burn because they burn slowly, and usually cannot be kept long enough within the furnace to be completely burned. The proper way to burn coal would be to treat it in such a way as to distill as volatile matter only light, easily burning gases, and leave all the rest of the combustible on the grate and burn it as a fixed solid. Laboratory experiments show that the amount and quality of the combustible driven off the coal by heating depends largely on the rate of heating; that is, when the rate of heating is slow, the total combutible matter driven off as volatile is small in quantity and gaseous in composition, while if the rate of heating the coal is very rapid the total volatile matter driven off is not only high in quantity but contains much tar vapor. It seems as though the hydrogen of the coal must be distilled off before burning and that when the coal is heated slowly the hydrogen on distillation takes only a small amount of carbon with it, leaving most of the latter on the grate as "fixed carbon"; if, however, the coal is heated very rapidly, the hydrogen comes off with a large amount of carbon and escapes as volatile matter, leaving a smaller quantity of the carbon on the grate in a fixed form. These facts bring us to the realization that there is no definite line between "fixed carbon" and "volatile matter."

According to the above, firing coal by hand is not the right way to burn it, because the pieces of coal fall on a very hot fuel bed and are heated in two or three minutes through a range of temperature of about 2,400 deg. F. This is a very high rate of heating and much of the carbon which, with a slow rate of heating would be left on the grate as "fixed," is driven away in combination with hydrogen in the form of heavy tar vapors. These tar vapors generally do not stay long enough in the furnace to burn, and hence leave the stack as smoke.

Most mechanical stokers are designed so that the coal is fed into the furnace gradually, and therefore the rate of heating is slow. The result is that a comparatively small amount of combustible is driven off as volatile matter, and it consists chiefly of easily burning gases, most of the carbon being left and burnt on the grate as fixed carbon; very small amounts of tarry vapors are distilled, whence the success of most mechanical stokers in burning smoky fuel. As an example, on a well-operated chain-grate stoker, it takes perhaps fifteen to twenty minutes to heat the coal through the same temperature range of 2,400 deg. F., which takes only two or three minutes in the hand-fired furnace. In general, the success of these mechanical stokers lies not in the fact that they consume smoke but that they burn the coal without producing much smoke at all.

Tar vapors and other heavy carbon-hydrogen compounds which are the product of distillation of coal under certain treatment burn slowly, and in order to burn them nearly completely they must be kept a comparatively long time within the furnace. To fulfill this condition the furnace must be provided with a large combustion space. Such furnaces, however, are objectionable for obvious reasons. The best remedy probably is to avoid the formation of all these slow-burning volatile compounds by using the principle of the low rate of heating of fresh fuel.

ANNUAL BANQUET PORTLAND N. A. S. E.

The annual banquet of Oregon No. 1, National Association of Stationary Engineers, held this week, brought together 50 members. The president of the local organization is B. W. Slocum, chief engineer of the Portland Railway, Light & Power Company; the secretary, O. I. Bennett, electrician for the same company, and the corresponding secretary and deputy president of the National Association, James D. Asher, chief engineer of the Hotel Portland.

Chief Engineer George Flower, of the Corbett building, was toastmaster, James D. Asher spoke on the aims of the organization. He told of the small beginning in October, 1882, when the National body was formed with but 12 delegates present from a half dozen States. The membership now is 20,000, scattered throughout the entire United States, and had 373 delegates at the last National convention. He read the preamble of the organization's constitution which he said had excited the admiration of every fair-minded employer in the United States who is familiar with it.

President Slocum, the next speaker, smilingly said that the local organization had talent enough to install any plant without the necessity of sending to Seattle for a man to do that work.

W. H. Corbett, of the Willamette Iron Works, followed with a brief address, expressing his satisfaction with the work of the organization and its co-operation with the Employers' Association. In the same vein B. C. Ball, of the Willamette Iron Works, and H. E. Judge of the Valvoline Oil Company, spoke briefly. The last two are associate members. C. P. Osgood, of the Portland General Electric Company, and M. H. McClung, also spoke, as did F. R. McIntosh, of the Diamond Brick Company, who was one of the delegates to the National Association last October, and who made a report of the work of that organization and of the entertainment provided in Columbus, O., for the visiting delegates.

Among those present were: B. C. Ball, E. M. Oatfield, J. D. Asher, H. W. Corbett, E. Edwards, C. P. Osgood, B. W. Slocum, J. D. Foller, J. Close, G. Haviland, B. F. Kirkland, H. C. Foster, J. H. Tamiesie, O. I. Bennett, G. H. Flower, F. R. McIntosh, C. E. Boswell, C. H. Feldman, J. G. Cunningham, W. H. Chambers, J. O. Gillan, W. J. Barnum, D. B. Kelly, H. E. Judge, George Harris, C. P. Klinger, E. C. Parker, J. W. Reddaway, George Bowers, N. R. Donlon, F. H. Irwin, J. B. Lineweber, Frank Lautenschlager, W. H. Adams, T. W. Starkey, C. T. Tennyson, A. E. Worth, O. H. Reed, P. Oberle, F. C. Miller, D. A. West, H. A. Walther, M. Moran, George De Boise, C. A. Crooks, H. J. Phillips, J. Dunlap, M. H. McClung, George Collenger, H. E. Raymond.

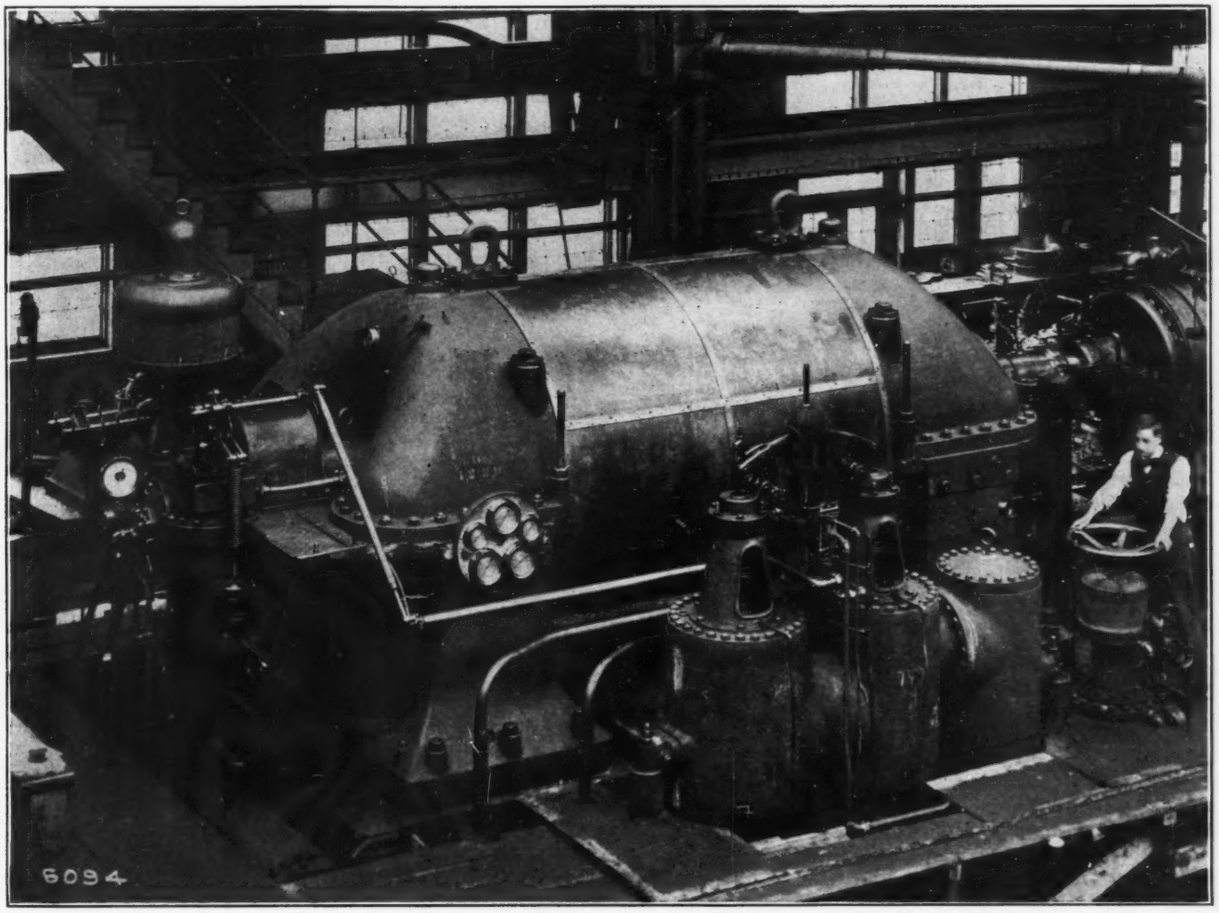
INDUSTRIAL

THE LARGEST STEAM TURBINE.

The accompanying photograph represents one of the largest steam turbine engines yet constructed, and was built by the Westinghouse Machine Company at the East Pittsburg shops, is now in transit to San Francisco and will be installed as quickly as possible in the plant of the City Electric Company.

This turbine has a capacity of 22,500 h. p. The unit runs at a speed of 1800 r. p. m. and is without question the most economical prime mover in this country.

This is the fourth turbine installed in this plant, there being three units in operation. The present units have a maximum capacity of 15,000 k. w. and when the fourth unit is installed there will be a total capacity of 30,000 k. w., making this the largest steam driven power plant west of Chicago. These units were furnished through Hunt, Mirk & Co., Pacific Coast representatives of the Westinghouse Machine Company.



22,500-Horsepower Westinghouse-Parsons Steam Turbine for City Electric Company, San Francisco.

Active construction will start on the Fruitvale station of the Southern Pacific Company, shortly after the first of January. Hunt, Mirk & Co., Inc., report that they now have one of the two 5000 k. w. Westinghouse Parsons turbines, together with its condenser and auxiliary equipment, delivered at the plant site, and active construction will start at an early date.

CHICAGO & NORTHWESTERN ROAD ADOPTS TELEPHONE FOR DISPATCHING.

The Chicago & Northwestern Railroad Company has recently purchased from the Western Electric Company apparatus for a complete telephone train dispatching circuit extending from Chadron, Nebraska, to Long Pine, Nebraska, a distance of 198 miles.

The telephone method of handling trains is of special value in sections such as that between Chadron and Long Pine, owing to the fact that during certain seasons of the year a great many of the stations consist simply of sidings. These stations, however, during a large portion of the year are important shipping points for the ranchers in that vicinity. In many places there are no telegraph stations and at such points telephones will be installed, rendering it possible for any authorized person to obtain stock cars or other freight accommodations much more rapidly than would be possible if it were necessary to handle the business through the nearest telegraph office.

At a great many of these sidings local freight trains and other trains are held waiting for passenger trains and in case of delays this arrangement has been a source of considerable expense, due to the fact that it has been impossible to get word to these trains and arrange for their forward movement. These delays will be minimized by the use of the telephone system of train dispatching.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY'S NEW REPAIR DEPARTMENT.

The new eight-story building, with approximately 220,000 feet of floor space, devoted partly to the manufacture of detail electrical apparatus and partly to repair work, which the Westinghouse Electric & Manufacturing Company not long ago placed in service, contains a new department, whose entire attention is devoted to the handling of repair work. For some time past the need of a special department to handle repair work independently of all other work, so as to insure prompt attention and quick deliveries, has been strongly felt, but the crowded condition of the works required the erection of another building before such a department as the management had in mind could be established.

On account of the fact that there was no large space on the company's 47-acre plot unoccupied, it was necessary, in the erection of a new building, to depart from the established two-story type of structure and erect a higher building. The available space was 110 ft. wide by 420 ft. long, and the building is 70 ft. by 400 ft. The distance from the ground to the top of the cornice is 130 ft. The building is of skeleton self-contained steel and brick construction, and is as near fireproof as a building can be made.

Although surrounded on all sides by other buildings, the new building has excellent receiving and shipping facilities. A covered shipping platform on the east side, paralleled by a railroad siding, extends the full length of the building. The ground floor is connected with the rest of the works by a narrow gauge industrial railway system, and the second floor is connected with the surrounding buildings by the means of covered bridges.

To facilitate the handling of material from floor to floor one exceptionally large freight elevator and five high-speed combination elevators are employed. They are all electrically operated by means of Westinghouse motors and controlled by automatic elevator controlling apparatus.

The building affords working space for approximately 1500 people. In addition to providing for practically doubling the present output of detail apparatus, it affords ample room for handling in the most expeditious manner a large volume of repair work.

The desirability of having electrical apparatus repaired by the manufacturer is apparent to every user, and the facilities afforded by this new department will no doubt be taken advantage of by all who have apparatus that needs overhauling and repairing.

In keeping with the well established standards of the company the same high grade and carefully selected material that entered originally into the apparatus will be used in work entrusted to the repair department. Expert workmen under the guidance of engineers of long experience, perform the work, and repaired apparatus is subjected to the same rigid tests as new apparatus. The facilities of the department enable repairs to be made in the most economical manner, and assure its redelivery in the shortest time consistent with good workmanship.

NEW CATALOGUES.

The Westinghouse Electric & Mfg. Co., in Circular No. 1181 have issued an interesting account of recent improvements in Portable Direct Current Ammeters and Voltmeters.

The Nelson Valve Co., Chestnut Hill, Philadelphia, Pa., sends an interesting booklet on Gate Valve Design, particular emphasis being laid on the advantages of the double disc taper seat type.

The Electric Storage Battery Company has issued valuable directions on "Some Points on the Operation and Care of 'Exide' Vehicle Batteries," in Bulletin No. 116. It is a reprint of a paper read by H. M. Beck before the Society of Automobile Engineers, at Chicago, Aug. 5, 6, 7, 1909.

The General Electric Company has issued Bulletin No. 4702 showing the various advantages to be gained by the use of the horizontal Curtis steam turbine in connection with the pumping equipment of fire boats. Various installations of these on the fire boats of New York and Chicago are both illustrated and described.

"Storage Batteries in Signal and Car Lighting Service" is the subject of Bulletin No. 117 from the Electric Storage Battery Company. This is an abstract of a paper read at a meeting of the Railway Signal, Car Lighting and Telegraph Engineers at Chicago, Sept. 23, 1909, by H. M. Beck. It deals with the installation, care and operation of storage batteries for the purpose specified.

Bulletin No. 4708, from the General Electric Company, describes an instrument recently placed upon the market by this company for use in the testing of wattmeters. The meter here described possesses all the requirements for rapid and accurate testing. It is portable and is inclosed in a neat wooden case which is provided with a leather handle. The meter is furnished in two distinct ampere ratings, each with single 110 volt, or double 110/220 volt potential windings.

The Sprague Electric Company is sending out an attractive folder, No. 434, describing and listing its line of stamped steel knockout boxes known as Multilets. As the name implies, one box is intended for many uses. Multilets are made in two sizes with a set of covers for each size. Multilets can thus be used for any necessary combination with rigid conduit, Greenfield flexible steel conduit or BX conductors. They accommodate standard fittings and do not require special fittings for special work.

The General Electric Company has recently issued two pamphlets which should be of special interest to owners of either electric or gasoline automobiles. The one illustrates and describes the method of charging electric automobiles from alternating current circuits by means of the General Electric rectifiers, and lists rectifiers of various capacities; the other shows the advantage of the use of not only electric light in connection with gasoline cars, but the use of the tungsten lamp to produce this light. The pamphlet contains a wiring diagram which will be of assistance to one contemplating the wiring of his machine. The numbers of these pamphlets are 3878 and 3874 respectively.

APPROVED ELECTRICAL DEVICES

MOULDING FITTINGS.

Paiste Moulding "Taplets." Porcelain fittings for use with wooden moulding. Branch Blocks, Cat. Nos. 4090-4094 inclusive. Crossovers for 2 or 3 wires. Cat. Nos. 4095-4098 inclusive. Approved Nov. 24, 1909. Manufactured by

H. T. Paiste Company, 32d and Arch Sts., Philadelphia, Pa.

"G. V." Galvanized cast iron boxes, Cat. Nos. 200-204 inclusive, with interchangeable covers; for use with wooden moulding. Approved Nov. 19, 1909. Manufactured by

The Gillette-Vibber Company, New London, Conn.

SWITCHES, PUSH BUTTON FLUSH.

"S. F." single and double pole switches, 10 A., 125 V. 5 A., 250 V., and 10 A., 250 V. respectively. Approved Nov. 13, 1909. Manufactured by

The Cutter Electrical & Mfg. Co., 19th and Hamilton Sts., Philadelphia, Pa.

SWITCHES, KNIFE.

"Worcester," Types A, B, C, D and E, 125, 250 and 600 volts; all capacities, with or without extension for N. E. Code cartridge or open link fuses. Approved Nov. 24, 1909. Manufactured by

Worcester Electric Mfg. Co., 42 La Grange St., Worcester, Mass.

NEWS NOTES

FINANCIAL.

LOS ANGELES, CAL.—The City Council has passed a resolution authorizing $3,500,000 in bonds for constructing works for generating and distributing electricity for the purpose of supplying the city with light, power and heat.

SAN FRANCISCO, CAL.—The Board of Supervisors has passed the ordinance calling for a special election on Friday, January 14th, for the purpose of submitting to the electors of the city the propositions for acquiring the Lake Eleanor and Sierra water supply and the Spring Valley Water Company.

LOS ANGELES, CAL.—Deputy City Attorney Wilson will file with the Supreme Court a petition for a writ of mandate compelling the City Clerk to certify the ordinance passed November 16th calling a special bond election to be held February 16th to submit a proposition to the people of incurring a debt of $6,500,000 for harbor improvement and construction of aqueduct power plants.

INCORPORATIONS.

SEATTLE, WASH.—Coon Power Company, capital $150,000, has been incorporated by H. Blow, S. H. Garrick and R. E. Coon.

SEATTLE, WASH.—American Gas & Electric Power Company, capital $10,000,000, has been incorporated by Benjamin H. Silver and Charles S. Hills.

BOZEMAN, MONT.—Articles of incorporation of the Norris-Bozeman Telephone Company have been filed by J. S. Dawes et al. The company has purchased the line between Bozeman and Norris and will make improvements and build other lines.

TACOMA, WASH.—The Centralia & Chehalis Gas Company has been incorporated by W. W. Seymour, Fred C. Brewer and T. L. Stiles, with a capital of $190,000 to operate gas lighting plants in Centralia and Chehalis. The principal office of the company will be in Tacoma.

SAN FRANCISCO, CAL.—Articles of incorporation of the Mt. Shasta Power Company, organized to develop electric power on the Pitt River, have been filed with the County Clerk. The company is capitalized at $1,000,000. Those most largely interested in the project are John Coffee Hays of Visalia, William A. Cooper and R. C. Johnson of San Francisco, H. V. Gates of Hillsboro, Cal. It is proposed to construct dams and erect machinery for the generation of electricity. Probably $2,000,000 will be expended in developing the rights taken over by the company. The directors, besides Hays, Cooper, Johnson and Gates, are Jesse A. Lilienthal, Albert Raymond and Archibald J. Treat. They have each subscribed for one share at $100.

TRANSMISSION.

TACOMA, WASH.—For carrying on the work of construction of the $2,000,000 Nisqually power project, the city will sell $100,000 worth of bonds December 22.

CHIHUAHUA, MEX.—Diego Redo, governor of Sinaloa, has been authorized to utilize for motor power the currents of the San Lorenzo River. The work of diverting the current of the river will be begun in April.

EUREKA, CAL.—S. E. Gamble of the Electric Light Construction Company of Eureka came up a week ago in company with Thos. Brett en route to Willow Creek where he will install an electric plant in the Clover Flat mine.

RAY, ARIZ.—The Ray Consolidated Copper Company is now preparing to install a subsidiary electric power plant at its main working shaft in order to prosecute development on ore bodies until the main electrical plant is completed at Winkelman.

EVERETT, WASH.—The Granite Falls Electric Company of Granite Falls, a corporation, has filed a petition with the County Commissioners of Snohomish County, asking for a franchise to erect upon the roads a line for the transmission of electricity for all purposes.

REDDING, CAL.—The Sacramento Valley Power Company which operates three power houses in this county with a system of power wires extending into the valley, and which claims ownership of approximately 100 inches of water rights in Shasta County, has executed a deed of trust to the Central Trust Company of San Francisco to secure the payment of bonds for $500,000. The money will be used in the extension of the company's power wires to various points in the Sacramento Valley.

PORTLAND, ORE.—The Portland Railway, Light and Power Company have closed a contract for a 10,000 horsepower steam plant to cost $750,000. Preliminary work is also in progress in the Upper Clackamas where the company proposes to install a 40,000 horse power plant at a cost of $3,000,000. The company will build a dam on the upper Clackamas 750 feet long and 155 feet high of solid masonry. The contract for sluicing the dirt off to bedrock has been let to Sellers & Rippy, who will start work at once.

TRANSPORTATION.

HONOLULU, H. I.—The Honolulu Street Railway Company is surveying King street preparatory to double-tracking the line through the downtown section.

WENATCHEE, WASH.—The Great Northern Railroad is to be electrified in Washington and will be operated by power to be developed at Lake Chelan.

FRESNO, CAL.—The Fresno Traction Company applied to the City Trustees last week for three street railway franchises. Its applications were referred to the ordinance committee.

SALT LAKE CITY, UTAH.—In asking for a city franchise to Main street, preliminary to electrifying its road, the Salt Lake & Los Angeles Railway Company proposes to build new tracks.

EL PASO, TEX.—The Interurban Valley line has asked for an extension of time on the El Paso railway of 90 days from December 10th, in which to commence work. This was granted.

SEATTLE, WASH.—An ordinance has been passed granting to the Seattle Electric Railway Company a franchise to construct a street railway on Fourteenth avenue and other streets in the city of Seattle.

CLAREMONT, CAL.—A petition signed by 65 property owners asking a postponement of sale of franchise for an electric railway between Pomona and Claremont has been presented by E. H. Sanford and others.

KENT, WASH.—The executive committee of the Valley Improvement Club, H. B. Madison of Kent, secretary, has been authorized to incorporate as the Independent Electric Railroad to build an electric railway from Renton to Kent, a distance of seven miles. It is believed the line can be built and equipped for $100,000.